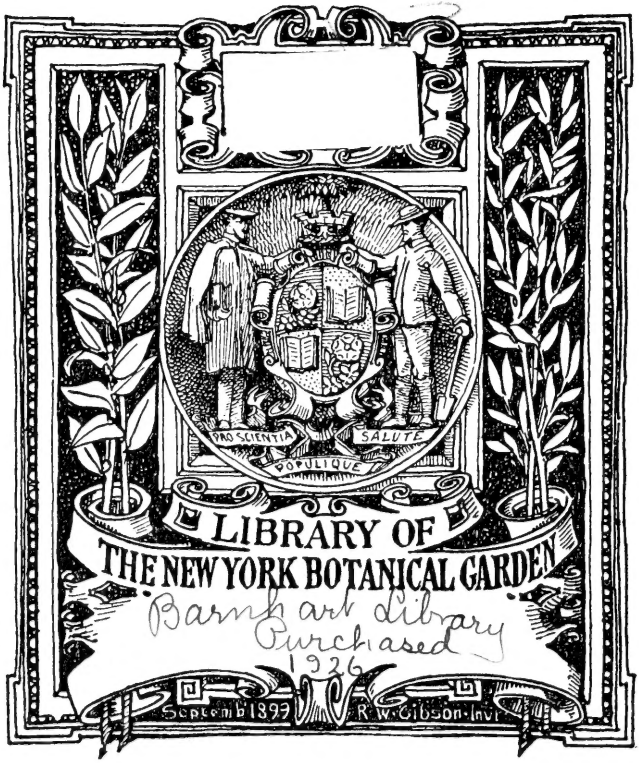
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ERRATUM.

On page 275, the paragraph beginning with the words "The physical circumstances" should follow immediately the paragraph ending with the words "the pyloric valve" on page 274, and form part of Mr. Macallum's paper on "The Alimentary Canal in Ganoid Fishes."

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OF

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BEING A CONTINUATION OF THE "CANADIAN JOURNAL" OF SCIENCE, LITERATURE AND HISTORY.

MARCH, 1885.

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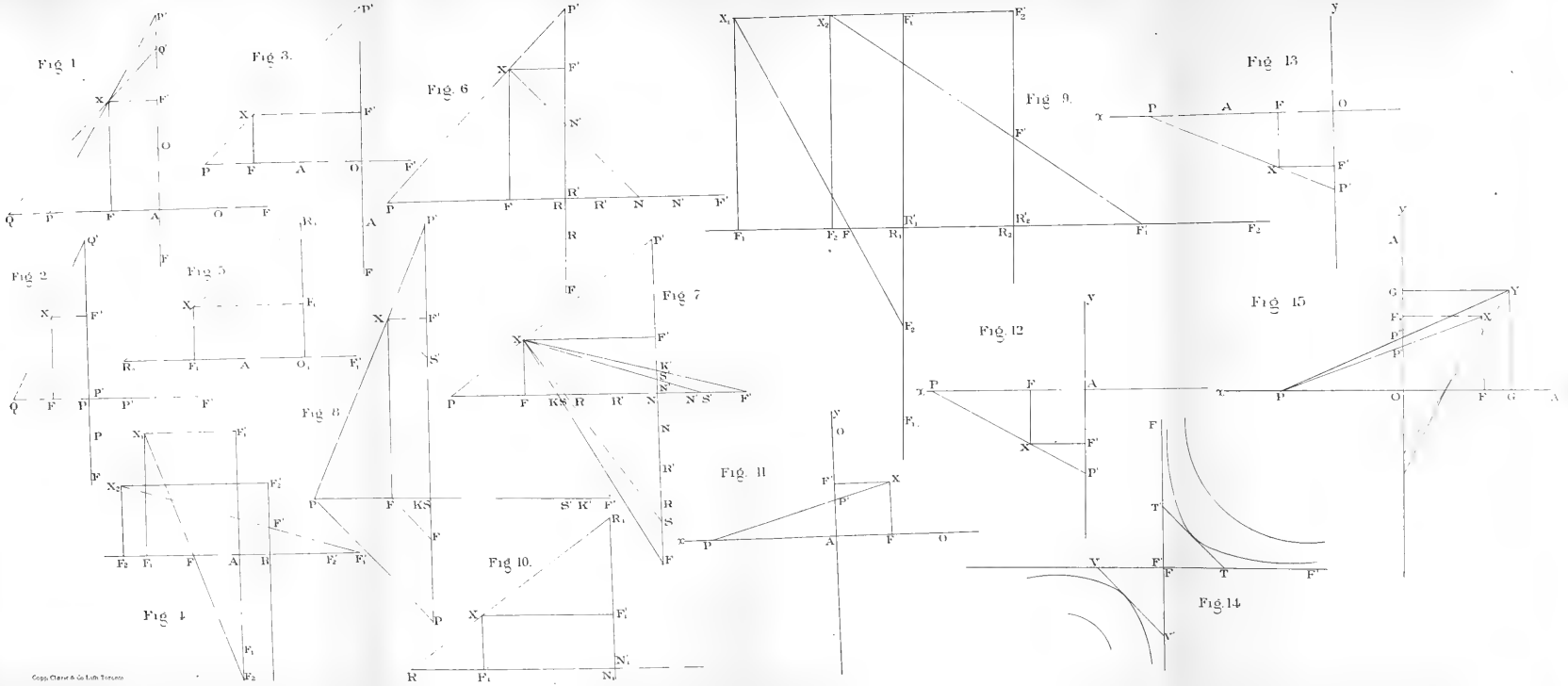
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SESSION 1884.

FIRST ORDINARY MEETING.

The First Ordinary Meeting of the Session 1884-'85, was held on Saturday, November 1st., in the Lecture Room of the Institute, the Second Vice-President, Dr. George Kennedy, in the Chair.

The minutes of last ordinary meeting were read and confirmed.

The following list of donations and exchanges was read :

I.—CANADIAN.

1. Proceedings and Transactions of the Nova Scotia Institute of Natural Sciences of Halifax, N.S., Vol. VI., No. 1, 1882-83.
2. Report on Canadian Archives for 1883, by Douglas Brymner, Archivist.
3. The Canadian Practitioner, June, July, August, September and October, 1884, 5 numbers.
4. Second Annual Report of the Provincial Board of Health of Ontario for 1883, 2 copies.
5. Monthly Weather Review for May, June, July, August and September, 1884, 5 numbers.
6. The Canadian Entomologist, Vol. XVI., Nos. 4, 5, 6, 7, April to July, 1884, 4 numbers.
7. Statutes of Ontario, 47th Victoria, 1st Session, 5th Legislature of Ontario held at Toronto, 25th July, 1884, 1 copy.
8. Manitoba Historical and Scientific Society :
   (1) Annual Report for the year 1883-84.
   (2) Transactions, No. 3, season 1883-84. Notes and Comments on Harmon's Journal, 1800-1820, by Rev. Prof. Bryce.
   (3) Transactions, No. 4. Fragmentary Leaves from the Geological Records of the Great North-West, by J. Hoyes Panton, M.A.

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(4) Transactions, No. 5, season 1883–84. "Our Water Supply," by Dr. Agnew.

(5) Transactions, 12, 13, 14. "The Red River," by W. Murdoch, Esq., C.E. "The Red River," by J. H. Rowan, Esq., C.E. "The Prairie Chicken," by Ernest E. T. Seton, Esq.

9. The Monthly Health Bulletin for Ontario, June, July and August, 3 numbers.
10. Inaugural Address delivered at the opening of the Law School in connection with Dalhousie University, Halifax, N.S., at the beginning of the first Term in 1883.
11. Report of the Meteorological Service of the Dominion of Canada, for the year ending December 31st, 1882, 2 copies.
12. Catalogue of the Central Circulating Library, Toronto, July 1st, 1884.
13. Ottawa Field Naturalists' Club, Transactions, No. 5, Vol. II., No. 1.
14. Label List of Insects of the Dominion of Canada, compiled by the Natural History Society of Toronto.
15. The Canadian Record of Science, Vol. I., No. 1.
16. On the Development of Physiological Chemistry and its Significance for Medicine, by Prof. Felix Hoppe-Seyler, translated by T. Wesley Mills, Esq., M.A., M.D., McGill College, Montreal.

Total Canadian, 36 numbers.

II.—UNITED STATES EXCHANGES.

1. Reports of the Peabody Museum of American Archaeology and Ethnology in connection with Harvard University, Vol. I., 1868–1876. Vol. II., Nos. 1, 2, 3, 4, 1877–80. Vol. III., Nos. 1, 2, 3, 4, 1881–84, 9 numbers.
2. Science Record, Vol. II., Nos. 7, 10, 11, 3 numbers.
3. Science, No. 68–90, 23 numbers.
4. Harvard University Bulletin for May, 1884, No. 28.
5. Proceedings of the Boston Society of Natural History, Vol. XXII., Part III.
6. Journal of the Franklin Institute for June, July, August, September and October, 1884, 5 numbers.
7. Annals of the New York Academy of Science, Vol. III., Nos. 1 and 2, 3 and 4, 2 numbers.

   Transactions of the New York Academy of Science, Vol. II., 1882–83.
8. Proceedings of the Academy of Sciences of Philadelphia, Part I., January to April, 1884.
9. Papers Concerning Early Navigation on the Great Lakes, by William Hodge. (From the Buffalo Historical Society).
10. Seventeenth Annual Report of the Peabody Institute of the City of Baltimore, June 1st, 1884.
11. Proceedings of the American Academy of Arts and Sciences. The Phases of the Moon, by Arthur Searle, April 9th, 1884.
12. The Workshop Companion, New York, 1879.
13. Preparation and Use of Concrete and Glue, New York, 1881.
14. Hints and Practical Information for Cabinet Makers, Upholsterers and Furniture men generally, New York, 1884.
15. Essex Institute Historical Collections for January, February and March, 1884, 1 number.

16. Bulletin of the Essex Institute :
    Vol. 15, Nos. 1–6, January to June, 1883.
    " 16, " 1–3, January to March, 1884, 3 numbers.
17. Appleton's Literary Bulletin, July, 1884?
18. Transactions of the Academy of Sciences of St. Louis, Vol. IV., No. 3, 1884.
19. United States Coast and Geodetic Survey. Report for the year ending June, 1882.
20. Bulletin of the Museum of Comparative Zoölogy at Harvard College, Vol. XI., No. 10.
21. Proceedings of the Newport Natural History Society for 1883–84.
22. Transactions and Proceedings of the American Society of Civil Engineers :
    Proceedings, Vol. X.
    Transactions, Vol. XIII., January to July, 1884.
    " August, 1884, 8 numbers.
23. Proceedings of the American Antiquarian Society, N. S., Vol. III., Part 2, April 1884.
24. Mineral Resources of the United States, by Albert Williams, jun., of the U. S. Geological Survey.
25. First Annual Report of the U. S. Geological Survey for the year ending June 30th, 1880.
26. Annual Report of the Board of Regents of the Smithsonian Institution for 1882.
27. Bulletin of the United States National Museum, No. 25. Contributions to the Natural History of the Bermudas, Vol. 1.
28. The Artesian Wells of Denver. (From the Colorado Scientific Society).

Total United States, 75 numbers.

III.—BRITISH EXCHANGES.

1. Transactions and Proceedings of the Botanical Society of Edinburgh, Vol. XV., Part 1, 1884.
2. Journal of the Anthropological Institute of Great Britain and Ireland, Vol. XIII., No. 4.
   Journal of the Anthropological Institute of Great Britain and Ireland, Vol. XIV., No. 1.
3. Proceedings of the Society of Antiquaries of Scotland, Vol. IV., N. S., 1881–82.
   Proceedings of the Society of Antiquaries of Scotland, Vol. V., N. S., 1882–83.
   Also to complete the set :
   Vol. I., Parts 1, 2 and 3, 1851–54.
   Vol. II., Parts 1 and 3, 1854–57.
   Vol. V., Part 2, 1863–64.
   Vol. IX., Part 1, 1870–71.
   Vol. XI., Part 2, 1875–76.
   Vol. XII., Parts 1 and 2, 1876–78. 12 numbers.
4. Journal of the Transactions of the Victoria Institute, Vol. XVIII., Nos. 69 and 70.

5. Archaeologia Aeliana, Vol. X., No. 1, N. S.
6. Proceedings of the Royal Geographical Society, N. S., Vol. 6, Nos. 6, 7, 8, 9 and 10, June to October, 5 numbers.
7. Proceedings of the Society for Psychical Research, Parts 1 to 5.
8. Journal of the Royal Microscopical Society, Series II., Vol. IV., Parts 3, 4 and 5, June to October, 3 numbers.
9. Minutes and Proceedings of the Institution of Civil Engineers, Vol. 76.
   " " " " " " Vol. 77.
10. Journal of the Quekett Microscopical Club, Series II., Vol. 1, Nos. 1–9, March, 1882, to July, 1884.
11. Trübner's American, European and Oriental Literary Record, Nos. 197 to 200.
12. Annual Report of the Leeds Philosophical and Literary Society, for 1883–84.
13. Monthly Notices of the Royal Astronomical Society, Vol. XLIV., Nos. 1 to 8, November, 1883, to June, 1884.
14. Proceedings of the Royal Colonial Institute, Vol. XV., 1883–84.
15. Transactions of the Manchester Geological Society, Vol. XVII., Parts 16, 17 and 18.
16. Memoirs of the Literary and Philosophical Society of Manchester :

    2 Series, Vol. II.

    3 Series, Vols. VII and VIII.

    Proceedings of same Society, Vol. XX., 1880–81.
    " " " Vol. XXI., 1881–82.
    " " " Vol. XXII., 1882–83.

Total Great Britain and Ireland, 63 numbers.

IV.—BRITISH COLONIES (EXCLUSIVE OF CANADA).

1. Papers and Proceedings of the Royal Society of Tasmania for 1882.
2. Records of the Geological Survey of India, Vol. XVII., Parts 2 and 3.
   Memoirs of the Geological Survey of India, Vol. XX., Parts 1 and 2.
   Palæontologia Indica :

   Series X., Vol. III., Part 1.
   " " " 2.
   " " " 3.

   Series XIV., Vol. 1-3, Fas. III.
3. Proceedings of the Asiatic Society of Bengal, No. II., February, 1884.
   " " " " " Nos. III., IV., and V., March to May, 1884.

   Journal of the Asiatic Society of Bengal, Vol. LII., Part I., Nos. 1, 2, 3 and 4, 1883.

   Vol. LIII., Part I., No. 1, 1884.
   Vol. LIII., Part II., No. 1, 1884.
4. Transactions and Proceedings of the New Zealand Institute for 1883, Vol. XVI.
5. Journal of the Royal Society of New South Wales for 1882, Vol. XVI.

Total British Colonies, 20 numbers.

V.—FOREIGN EXCHANGES.

1. Mittheilungen der Anthropologische Gesellschaft in Wien, XIV. Band, 1 Heft, 1884.
2. Atti del Società Toscana di Scienze Naturali :
   Memoirs, Vol. VI., Fas. 1, Processi Verbali. Indici dei Volumi II., III. and IV., pp. 53 to 70.
3. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, Mars, Avril et Mai, 1884.
4. Mémoires de la Société Royale des Antiquaires du Nord, N. S., 1880.
5. Revista Trimensal do Instituto Historico Geographico e Ethnographico do Brazil, Tomo XLVI., Parte 1 e 2.
6. Correspondenz-Blatt der Deutschen Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, XV. Jahrgang, for April, May, June, July and August, 1884, 5 numbers.
7. Oversigt over det K. Danske Videnskabernes Selskabs Forhandlinger, 1883.
   Bulletin, No. 3, October to December, 1884.
   Bulletin, No. 4, January to March, 1884.
8. Le Globe, Tome III. :
   Bulletin, No. 1.
   Bulletin, No. 2.
   Mémoires, Septembre, 1884.
9. Bulletin de la Société Géologique de France :
   3 Série t. X., No. 7, Feuilles 33–44, 1882.
   " t. XI., No. 8, " 40–48, 1883.
   " t. XII., No. 7, " 26–32, 1884.
10. Astronomische, Magnetische und Meteorologische. Beobachtungen an der K. K. Sternwarte, zu Prag, 1883.
11. Boletin de la Academia Nacional de Ciencias in Cordoba (Republica Argentina), Tomo VI., Entrega 1*a*, 1884.
12. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Sitzung vom 19 Januar, 1884.
    Sitzung vom 16 Februar ; vom 15 März und 19 April, 4 numbers.
13. Archivio per L'Antropologia e la Etnologia e Psicologia Comparata, Quattordicesimo Volume, Firenze, Fasicolo Primo, 1884.
14. Ymer Tidskrift Utgifven af Svenska Sällskapet för Anthropologi Och Geografi, 1884, 1 to 4 Häftet.
15. Archives Néerlandaises des Sciences Exactes et Naturelles, Vol. XIX., No. 2.
    Do., to complete a set :
    Tomes I. to VIII.
    " IX., Livraisons, 1, 2, 3.
    " XIII., " 4, 5.
    " XVI., " 3, 4, 5.
    " XVIII., " 2, 3, 4, 5.
    " XIX., " 1.
16. Bulletin de la Société d'Anthropologie de Paris, Tome Septieme (III. Série) 1 and 2, Fascicules, Janvier à Mars, 1884, et Mars à Mai, 1884.

17. Bulletin de la Société Royale de Botanique de Belgique, Tome Vingt-deuxième.
18. Sitzungsberichte der Naturforschende Gesellschaft zu Leipzig, Neunter Jahrgang, 1882, und Zehnter Jahrgang, 1883.
19. Arbók hins Islenzka Fornleifafélags, 1883, (Icelandic Archaeological Society) Reykjavik, 1884.
20. Verhandlungen der Naturhistorischen Vereines der Preussischen Rheinlande und Westfalens.

    Vierzigster Jahrgang, Zweite Hälfte.

    Ein und vierzigster Jahrgang, Erste Hälfte, Bonn, 1883–84.
21. Allgemeine Grundzüge der Ethnologie, von Prof. Dr. Adolf Bastian, Berlin, 1884.
22. Archives du Musée Teyler, Série II., Vol. I., Quatrième Partie.
23. Programme de la Société Hollandaise des Sciences à Harlem, 1883.
24. Verhandlungen der K. K. Zoologisch-Botanische Gesellschaft in Wien, Jahrgang 1883, Band XXXIII.
25. Brasilische Säugethiere Beiheft zu Band XXXIII.
26. Mittheilungen der K. K. Geographischen Gesellschaft in Wien, 1883, XXVI. Band.
27. Nachrichten von der K. Gesellschaft der Wissenschaften und der Georg Augusts Universität zu Göttingen, 1883, 1 to 13.
28. Dreiundzwanzigster Bericht der Oberhessischen Gesellschaft für Natur und Heilkunde, Giessen im Juni, 1884.
29. Jahrbuch der K. K. Geologischen Reichsanstalt, Jahrgang 1883, XXXIII. Band.

    No. 4, October, November und December.

    Do., Jahrgang 1884, XXXIV. Band, Hefte 1, 2, 3, Wien, 1884.
30. Sitzungsberichte der philosophisch-philologischen und historischen Classe der K. B. Akademie der Wissenschaften zu München, 1883, Hefte 1, 2, 3, 4.
31. Sitzungsberichte der mathematisch-physikalischen Classe der K. B. Akademie der Wissenschaften zu München, Hefte 1, 2, 3.
32. Anales del Museo Nacional de México, Tomo III., Entrega 6*a*.
33. Ueber Herkunft und Sprache der Transgangetischen Völker, Von Ernst Kulm.

    Akademie der Wissenschaften zu München, am 25th Juli, 1881.
34. Gedächtnissrede auf Karl Von Halm, Von Eduard Wölfflin, 28 März, 1883.
35. Ueber die Methoden in der botanischen Systematik insbesondere die anatomische Methode, Von Ludwig Radlkofer, 25 Juli, 1883.
36. Schriften der physikalisch-ökonomischen Gesellschaft, zu Königsberg, vierundzwanzigster Jahrgang, 1883, Abtheilungen 1 und 2.
37. Verhandelingen der K. Akademie van Wetenschappen, XXIII. Deel, Amsterdam, 1883.
38. Verslagen en Mededeelingen der K. Akademie van Wetenschappen. Afdeeling Natuurkunde. Tweede Reeks, Deel XVIII., Amsterdam, 1883.
39. Jaarboek van de K. Akademie van Wetenschappen, Amsterdam, 1882.
40. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XI., Nos. 1, 2, 3, 4, 5.

Total Foreign, 93 numbers.

Professor Young then read a paper on the "Solutions of Equations of the Fifth Degree." The object of the paper was, in the first place, to determine the criterion of the solubility of the quintic equation; and next, assuming the conditions of solubility to exist, to solve the equation.

A short discussion followed, in which Mr. Livingston and Prof. Galbraith took part.

Prof. J. Loudon also read a paper entitled :—

GEOMETRICAL METHODS CHIEFLY IN THE THEORY OF THICK LENSES.

1. In cases of reflection or refraction at a spherical surface, or a combination of spherical surfaces, or lenses, if F, F′ be the primary and secondary principal foci of the surface, lens, or combination, and (P, P′), (R, R′) pairs of conjugate points, it is known that

$$\frac{f}{p}+\frac{f'}{p'}=1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where $f = \mathrm{RF}$, $p = \mathrm{RP}$, $f' = \mathrm{R'F'}$, $p' = \mathrm{R'P'}$; and where the positive direction from R for f and p is opposite to, whilst that from R′ for f' and p' is the same as, the direction of the incident pencil.

Now since the relation (1) expresses the condition that the line $\frac{x}{p}+\frac{y}{p'}=1$ passes through the point (f, f'), it follows that if the coincident lines FRR′F′, FRR′F′ be separated so that R on the x or object-axis coincides with R′ on the y or image-axis, the line joining P on the former to P′ on the latter will always pass through the fixed point (f, f'). Hence we derive a geometrical method for determining the point conjugate to any given one.

The points R, R′ from which distances are measured, it is to be observed, are any two conjugate points, such, for example, as the principal points, or nodal points; and they may in particular cases coincide when they are self-conjugate.

It is proposed in the following paper to employ the method indicated chiefly in discussing certain propositions in the theory of thick lenses.

I.

2. In the case of refraction at a single spherical surface

$$\frac{f}{p}+\frac{f'}{p'}=1$$

where f, f' are the distances of the primary and secondary principal foci F, F', and p, p' the distances of the object and image P, P', from A, the point where the principal axis meets the sphere.

Let the standard case be that of refraction into a denser medium, whose surface is convex, the direction of the light being from left to right. Then drawing axes AF, AF', and taking the point X (f, f'), as in Fig. 1, we see that the point conjugate to P on one axis is the intersection of PX with the other.

It appears from the figure that A is a self-conjugate point, as also O, FO being equal to FX.

3. From similar triangles PFX, XF'P', it is immediately seen that

$$ff' = dd',$$

where $PF = d$, $P'F' = d'$.

If the rule of signs (§ 1) be applied to the measurement of d, d' on the two axes, it is to be observed that they are of the same sign, both being negative, for example, in Fig. 1.

4. If P, P' are conjugate points, as also Q, Q', then drawing PXP', QXQ', as in Fig. 1, we have

$$dd' = (d + PQ)\,(d' - P'Q')$$

which reduces at once to

$$-\frac{d}{PQ} + \frac{d'}{P'Q'} = 1.$$

This is of the form

$$\frac{d}{D} + \frac{d'}{D'} = 1 \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where the distances d, D are measured from P, and d', D' from its conjugate P', the rule of signs being that already referred to in § 1.

5. Fig. 2 exhibits the construction adapted to formula (2). P in the x axis coincides with its conjugate P' in the y axis, and the line joining any other two conjugate points (Q, Q') on the two axes passes through the point (d, d').

If the origin be the self-conjugate point O, the centre of the sphere, the relation (2) becomes

$$\frac{f'}{p} + \frac{f}{p'} = 1,$$

where (Fig. 3) $OF = f'$, $OP = p$, &c.

As in § 3 we have $dd' = f'f$.

6. The following proposition which is employed by Helmholtz (*vide* Optique Physiologique, p. 72), I have modified by changing his notation and applying the rule of signs (§ 1), in order to exhibit the result of the elimination in a symmetrical form.

Let there be any number of spherical refracting surfaces whose principal foci are (F_1, F'_1), (F_2, F'_2), &c., and which cut the common principal axis in A, B, C, . . . Let (R_0, R_1), (R_1, R_2) . . . be pairs of conjugate points, such that $R_0F_1 = d_0$, $R_1F'_1 = d'_1$, . . . In like manner let (P_0, P_1), (P_1, P_2) . . . be any other set of conjugate points, such that $R_0P_0 = p_0$, $R_1P_1 = p'_1$, . . . Then by § 4

$$\frac{d_0}{p_0} + \frac{d'_1}{p'_1} = 1,$$

$$\frac{d_1}{p_1} + \frac{d'_2}{p'_2} = 1, \text{ \&c.}$$

Also by the rule of signs (§ 1) we have $p_1 = -p'_1$, $p_2 = -p'_2$, . . . Hence, on eliminating these quantities, the position of P_n, the point conjugate to P_0 with reference to the system, is determined from an equation of the form

$$\frac{f}{p_0} + \frac{f'}{p'_n} = 1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

where $f = R_0F$, $f' = R_nF'$, F, F' being the principal foci of the system.

The values of $\frac{f}{d_0}$ for 2, 3, 4 . . . refractions are, respectively,

$$\frac{d_1}{d_0 + d'_1}, \quad \frac{d_1d_2}{d_1d_2 + d'_1d_2 + d'_1d'_2}, \quad \frac{d_1d_2d_3}{d_1d_2d_3 + d'_1d_2d_3 + d'_1d'_2d_3 + d'_1d'_2d'_3}, \ldots$$

and the corresponding values of $\frac{f'}{d'_2}, \frac{f'}{d'_3}, \frac{f'}{d'_4}$, are

$$\frac{d'_1}{d_1 + d'_1}, \quad \frac{d'_1d'_2}{d_1d_2 + d'_1d_2 + d'_1d'_2}, \quad \frac{d'_1d'_2d'_3}{d_1d_2d_3 + \ldots}, \ldots$$

7. The construction of § 5 (Fig. 2) applies to equation (3), and from the figure we at once deduce, as in §§ 3, 4, the general relations

$$dd' = ff', \frac{d}{D} + \frac{d'}{D'} = 1.$$

The latter, it may be observed, also follows from (3), since R_0, R_n are *any* conjugate points.

8. The principal foci F, F′ of a system of two surfaces S_1, S_2 constituting a lens may be found as follows :—

Let (F_1, F'_1), (F_2, F'_2) be the principal foci of S_1 and S_2, which cut the principal axis in A, B, respectively, so that $AF_1 = f_1$, $AF'_1 = f'_1$, . . . In Fig. 4 take the points X_1 (f_1, f'_1) referred to A as origin, and X_2 (f_2, f'_2) referred to B. Then since parallel rays on emergence from the system come from F_2, F_2 is the image of F in S_1. Therefore the line joining X_1 and F_2 on the y axis will cut the x axis in F.

Again, since parallel rays on incidence go to F'_1 and thence to F′, F′ is the image of F'_1 in S_2. Therefore the line joining X_2 and F'_1 on the x axis will give F′ on the y axis.

The principal foci of any system of surfaces may be determined in like manner.

9. In the case of a lens the distances AF, BF′ may be readily found as follows in terms of $f_1, f_2, \ldots$

From the similar triangles FAF_2, $X_1F'_1F_2$ (Fig. 4) we have

$$\frac{AF}{AF_2} = \frac{F'_1X_1}{F'_1F_2}, \text{ that is } \frac{AF}{f_2 - e} = \frac{f_1}{f'_1 + f_2 - e}.$$

where $AB = e$.

Also from the similar triangles $F'BF'_1$, $X_2F_2F'_1$

$$\frac{BF'}{BF'_1} = \frac{F_2X_2}{F_2F'_1}, \text{ or } \frac{BF'}{f'_1 - e} = \frac{f'_2}{f'_1 + f_2 - e}.$$

These values can also be deduced from the relation of § 3. Thus, taking the x axis of the figure,

$$F_1F \cdot F'_1F_2 = f_1f'_1, \text{ \&c.}$$

10. In the system referred to in § 6 the lengths of the images (ω_1, ω_2 . . .) which an object ω_0 at R_0 produces at R_1, R_2 . . . may be determined as follows :—

Let O_1 be the centre and f_1, f'_1 the principal focal lengths of S_1, &c.

Then (Fig. 5)

$$\frac{\omega_1}{\omega_0} = \frac{O_1R_1}{O_1R_0} = \frac{F_1X}{F_1R} = \frac{f_1}{d} = \frac{d}{f}$$

In like manner,

$$\frac{\omega_2}{\omega_1} = \frac{f}{d} = \frac{d'_2}{f}, \text{ \&c.}$$

From these relations we find

$$\frac{\omega_2}{\omega_0} = \frac{d'_1 d'_2}{f'_1 f'_2} = \frac{f_1 f_2}{d_0 d_1},$$
$$\frac{\omega}{\omega_0} = \frac{d'_1 d'_2 d'_3}{f'_1 f'_2 f'_3} = \frac{f_1 f_2 f_3}{d_0 d_1 d_2}, \text{ \&c.}$$

Hence if $\omega_0 = \omega_n$, each of the nth equalities becomes equal to 1, and the points R_0, R_n the principal points of the system.

Thus, if $n = 2$, $d_0 d_1 = f_1 f_2$, and $d'_1 d'_2 = f'_1 f'_2$.

Also, since $AR_1 = f'_1 - d'_1$, $BR_1 = f_2 - d_1$, we have

$$d_1 + d'_1 = f'_1 + f_2 - e;$$

and the values of the principal focal lengths become

$$f = \frac{f_1 f_2}{f'_1 + f_2 - e}, \quad f' = \frac{f'_1 f'_2}{f'_1 + f_2 - e}.$$

11. Now let R, R′ be the principal points, F, F′ the principal foci of a thick lens; so that we have

$$\frac{f}{p} + \frac{f'}{p'} = 1. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Fig 6, in which X is the point (f, f'), exhibits the method of finding the conjugate of a given point.

12. Conjugate points will be nodal points N, N′ when on the x axis we have $NN' = RR'$. This will evidently happen when (Fig. 6) the line through X makes $FN = FX$. $RN\ (= f' - f)$ on the x axis will then be equal to $R'N'$ on the y axis.

If distances are measured from the nodal points N, N′, equation (4) becomes $\frac{f'}{p} + \frac{f}{p'} = 1$, in which f', p are measured from N, and f, p' from N′; and the conjugate points are determined as in Fig. 7.

13. These figures make the existence of self-conjugate points manifest. Thus in Fig. 7, if S is such a point, we have

$$FS.\ F'S = ff', \quad FS + F'S = FF' = 2h.$$

Hence FS, F′S are the roots of $s^2 - 2hs + ff' = 0$, and the self-conjugate points are at equal distances from F, F′.

14. Fig. 8 exhibits the construction when one of the self-conjugate points is taken as origin.

From the similar triangles PP′P, S′P′X, and also PSP, FSF, we obtain the relations

$$\frac{PSP'}{S'P} = \frac{PP}{S'X} = \frac{PP}{FF} = \frac{SP}{SF}.$$

15. If F is the image of K, and K′ of F′, then on the x axis of Fig. 8 we have

$$FK \cdot FF' = FS \cdot F'S = FF' \cdot F'K'$$

Hence

$$FK = F'K' = \frac{ff'}{2h}.$$

Also, if T, T′ are conjugates such that FT = F′T′, then

$$FT^2 = FT \cdot F'T' = ff'.$$

It thus appears that the middle point of FF′ also bisects the lines KK′, SS′, RN′, R′N, TT′ and (*vide* § 28) VV′.

16. The method of § 6 may be applied as follows to a system of lenses.

Let there be any number of lenses L_1, L_2, . . . whose principal foci are (F_1, F'_1), (F_2, F'_2) . . . , and whose principal planes cut the common axis in (A, A′), (B, B′) . . .

Let (R_0, R_1), (R_1, R_2) . . . be pairs of conjugate points such that $R_0F_1 = \delta_0$, $R_1F'_1 = \delta'_1$, $R_1F_2 = \delta_1$, . . . In like manner let (P_0, P_1), (P_1, P_2), . . . be any other set of conjugate points such that $R_0P_0 = p_0$, $R_1P_1 = p'_1$, . . .

Then (§ 7)

$$\frac{\delta_0}{p_0} + \frac{\delta'_1}{p'_1} = 1,$$

$$\frac{\delta_1}{p_1} + \frac{\delta'_2}{p'_2} = 1, \text{ \&c.};$$

from which by eliminating $p_1 = -p'_1$, $p_2 = -p'_2$, . . . we get an equation of the form

$$\frac{f}{p_0} + \frac{f'}{p'_n} = 1,$$

where $f = R_0F$, $f' = R_nF'$, F, F′ being the principal foci of the system.

17. The principal foci F, F′ of a system of lenses may be determined geometrically as in § 8.

Thus, let there be two lenses L_1, L_2, whose principal foci are (F_1, F'_1), (F_2, F'_2), and principal points (R_1, R'_1), (R_2, R'_2). Then (Fig. 9), since parallel rays on emergence come from F_2, F_2 is the image of F in L_1. Hence the line joining X_1 and F_2 on the y axis gives F on the x axis.

Again, since parallel rays on incidence go to F'_1, and thence to F', F' is the image of F'_1 in L_2. Hence the line joining X_2 and F'_1 on the x axis gives F' on the y axis.

In the construction, of course, any pairs of conjugate points may be employed instead of the principal points.

18. In the system of § 16 the lengths of the images $(\omega_1, \omega_2 \ldots)$ which an object ω_0 at R_0 produces may be determined as follows :—

Let (f_1, f'_1), (f_2, f'_2) . . . be the principal focal lengths of L_1, L_2, . . .

Then, since (§ 20) in a thick lens the ratio of the lengths of object and image is that of their respective distances from the nodal points, we have (Fig. 10),

$$\frac{\omega_1}{\omega_0} = \frac{N'_1R_1}{N_1R_0} = \frac{F_1X}{F_1R_0} = \frac{f_1}{\delta_0} = \frac{\delta'_1}{f'_1}.$$

In like manner we have

$$\omega_2 = \omega_1 \frac{f_2}{\delta_1} = \omega_1 \frac{\delta'_2}{f'_2}$$

$$= \omega_0 \frac{f_1 f_2}{\delta_0 \delta_1} = \omega_0 \frac{\delta'_1 \delta'_2}{f'_1 f'_2}\text{ ; \&c.}$$

Hence if $\omega_0 = \omega_n$, R_0, R_n become the principal points of the system, and

$$\delta_0\delta_1 \ldots = f_1 f_2 \ldots$$

$$\delta'_1\delta'_2 \ldots = f'_1 f'_2 \ldots$$

19. The equation for the system of lenses being $\frac{f}{p} + \frac{f'}{p'} = 1$, referred to principal points, the corresponding equation, when the nodal points are origins, becomes $\frac{f'}{p} + \frac{f}{p'} = 1$, in which f', p are measured from N, and f, p' from N'.

20. The lengths of object and image at various pairs of conjugate points may now be compared.

Thus (Fig. 7), if ω at P gives ω' at P', we have †

$$\frac{\omega + \omega'}{\omega'} = \frac{PR}{RF} = \frac{PF}{RF} + 1.$$

† *Vide* Croullebois, *Lentilles épaisses*, p. 32.

Therefore

$$\frac{\omega}{\omega'} = \frac{PF}{FX} = \frac{PN}{P'N'},$$

the relation on which is based the definition of nodal points.

It would seem preferable, however, after having proved the existence of nodal points †, to reverse these steps, and from $\frac{\omega}{PN} = \frac{\omega'}{P'N'}$ to deduce $\frac{\omega}{\omega'} = \frac{PF}{FX}$, &c.

21. Again, if ω at N gives ω' at N′,

$$\frac{\omega f}{RN} = \frac{\omega' f'}{R'N'}.$$

Therefore

$$\frac{\omega}{f'} = \frac{\omega'}{f},$$

that is, the apparent magnitude of ω at F is equal to that of ω' at F′.

22. If ω at S gives ω' at S, then (Fig. 7) from the similar triangles SNS, SF′X, XFS we have

$$\frac{\omega}{\omega'} = \frac{NS}{N'S} = \frac{f'}{SF'} = \frac{SF}{f}.$$

In like manner if ω at S′ gives ω'' at S′ we have

$$\frac{\omega}{\omega''} = \frac{SF'}{f} = \frac{f'}{SF}.$$

Hence from the last two relations

$$\frac{\omega}{f'} = \frac{\omega'}{SF'} = \frac{\omega''}{SF}.$$

23. If ω at K gives ω' at F, and ω at F′ gives ω'' at K′, then (Fig. 7)

$$\frac{\omega}{\omega'} = \frac{NK}{N'F} = \frac{F'X}{F'F} = \frac{f'}{2h},$$

and

$$\frac{\omega}{\omega''} = \frac{NF'}{N'K'} = \frac{FF'}{FX} = \frac{2h}{f}.$$

† *Vide* Helmholtz, *Optique physiologique*, p. 75.

II.

24. The geometrical method of the preceding sections may also be extended to the case of reflection at one or more spherical surfaces. A few examples will suffice to illustrate the method.

Thus for a convex mirror F and F′ are coincident; f is negative and f' positive, and formula (1) becomes

$$-\frac{f}{p}+\frac{f}{p'}=1.$$

Hence the line joining conjugate points on the two axes passes through X $(-f, f)$, as in Fig. 11.

For a concave mirror the formula is

$$\frac{f}{p}-\frac{f}{p'}=1,$$

and X is $(f, -f)$, as in Fig. 12.

25. In either case we have, from the similar triangles PFX, XF′P′ (Fig. 11 or 12),

$$\frac{\mathrm{PF}}{\mathrm{FX}}=\frac{\mathrm{F'X}}{\mathrm{P'F'}},$$

that is

$$dd'=f^2,$$

which is Newton's formula.

If d and d' be measured respectively from P and P′ in accordance with the rule of signs (§ 1), this formula should be written

$$dd'=-f^2,$$

as appears by deducing it from the relation $dd'=ff'$ of § 3.

26. The relation between the lengths of the object and image is most readily obtained by making the axes cross at O, the centre of the mirror.

Thus for a convex mirror we have (Fig. 13)

$$\frac{\omega'}{\omega}=\frac{\mathrm{OP'}}{\mathrm{OP}}=\frac{\mathrm{FX}}{\mathrm{PF}}=\frac{f}{d}.$$

In the case either of a convex or a concave mirror it may be remarked that, if account be taken of the signs of f, f', d, d', the relation

$$\frac{\omega'}{\omega}=\frac{f}{d}=\frac{d'}{f'}$$

determines whether the image is erect or inverted, the sign of $\frac{\omega'}{\omega}$ being positive in the former case, and negative in the latter.

27.* The method may also be applied to determine the spherical aberration of mirrors.

Thus in the case of a concave mirror if distances are measured from the centre O, and if the incident ray PI is reflected at I so as to cut the axis after reflection in P″, we know that

$$-\frac{f\sec\alpha}{p}+\frac{f\sec\alpha}{p''}=1,$$

where α is the angle AOI, $OP=p$, and $OP''=p''$.

But, P′ being conjugate to P, we have

$$-\frac{f}{p}+\frac{f}{p'}=1,$$

where $OP'=p'$.

Hence, if the separated axes cross at O, as in Fig. 15, whilst PP′ always passes through X $(-f,f)$, PP″ always passes through Y $(-f\sec\alpha, f\sec\alpha)$. P′P″ on the y axis will accordingly represent the longitudinal aberration, whose direction is seen from an inspection of the figure to be from O to A except when P lies between F and G.

The value of the aberration may be determined by comparing the similar triangles POP′, PFX, POP″, PGY. Thus

$$\frac{P'P''}{p}=\frac{p''-p'}{p}=\frac{f\sec\alpha}{p+f\sec\alpha}-\frac{f}{p+f}$$

whence we get $P'P''=\dfrac{p^2f(1-\cos\alpha)}{(p+f)(p\cos\alpha+f)}$, the ordinary expression.

If $PF=d$, and $PG=\triangle$, we also have

$$\frac{p''-p'}{p}=\frac{\triangle-p}{\triangle}-\frac{d-p}{d}$$

$$=\frac{p}{d}-\frac{p}{\triangle}.$$

Therefore $p''-p'=p^2\left(\dfrac{1}{d}-\dfrac{1}{\triangle}\right)$.

It may be remarked that FG is the principal longitudinal aberra-

* This section was added December, 1884.

tion, and that the figure also gives the relation $\triangle\triangle' = f^2 \sec^2 \alpha$, where $\triangle' = P''G$.

In the case of a convex mirror X and Y will lie in the opposite quadrant and the longitudinal aberration will be found to be

$$p^2\left(\frac{1}{\triangle} - \frac{1}{d}\right).$$

III.

28. Since writing the above it has occurred to me that the relation $dd' = ff'$ leads to two other simple geometrical methods for exhibiting the relations between the conjugate points.

Thus if we separate the two axes FF', FF' so that F in the x axis coincides with F' in the y axis, as in Fig. 14, then evidently the feet of the ordinates drawn from any point on the hyperbola $xy = ff'$ will be conjugate to one another. This construction gives us a readier means of finding many of the points whose positions have already been discussed.

Thus self-conjugate points are at once given by

$$x\,(2h - x) = ff';$$

and the points K, K' (§ 15) by

$$2hx = ff'.$$

Again, H being the middle point of FF', if H is the image of G, and J of H, we have

$$F'J = \frac{ff'}{h} = 2FK = FG.$$

29. From the construction of the preceding section it appears that the lines joining pairs of conjugate points on the two axes touch the hyperbola

$$4xy = ff'.$$

Fig. 14 shows that the conjugate points V, V' are equidistant from H, the middle point of FF', and that

$$FV = F'V' = FT = \sqrt{ff'}.$$

Prof. Galbraith, Mr. Wm. Houston, and Mr. A. Baker took part in the discussion which followed.

SECOND ORDINARY MEETING.

The Second Ordinary Meeting of the Session 1884-'85, was held on Saturday, November 8th, the President, Prof. W. H. Ellis, in the Chair.

The minutes of last meeting were read and confirmed.

The following gentlemen were elected members of the Institute :—

T. J. Mulvey, B.A., T. A. Haultain, B.A., H. R. Wood, B.A., J. H. Bowes, B.A., Charles Whetham, B.A., J. C. Smoke, M.A., Geo. G. S. Lindsey, B.A., F. C. Mensinga, Esq., W. Dale, M.A., W. A. Frost, B.A., Geo. Inglis, B.A., John Nairn, Esq., J. D. Barnett, Esq., D. H. Talbot, Esq., Prof. T. Nelson Dale, Rev. George Burnfield, M.A.

The following list of donations and exchanges received since last meeting was read :

1. The Canadian Practitioner for November, 1884.
2. Science, Vol. IV., No. 91, October 31st, 1884.
3. Science Record, Vol. II., No. 12, October 15th, 1884.
4. Journal of the Franklin Institute for November, 1884.
5. Proceedings of the Cambridge Philological Society, Vols. VII. and VIII., Lent and Easter Terms, 1884.
6. Bulletin de la Société d'Anthropologie de Paris, Tome Septième (IIIe Serie) 3e Fascicule, Mai à Juillet, 1884.

Prof. T. Nelson Dale then read the following paper :—

ON METAMORPHISM IN THE RHODE ISLAND COAL BASIN.

Sir Charles Lyell, in a paper read before the Geological Society of London in 1844, called the attention of British Geologists to the occurrence near Worcester, in Massachusetts, of a bed of Plumbago and Anthracite, which he was inclined to believe belonged to the Carboniferous Formation.* The Geological Survey of Rhode Island by Dr. Jackson, published in 1840, that of Massachusetts by President Edward Hitchcock in 1841, a short paper by the same on the Rhode Island coal field in 1853, as well as two papers by his son,

* Ch. Lyell, On the probable age and origin of a bed of Plumbago and Anthracite occurring in Mica-schist near Worcester, Mass.—Quarterly Journal of the Geological Society of London, Vol. I., 1845. See also on the Worcester beds the following paper, which has appeared since mine was read. Joseph H. Perry, Note on a Fossil Coal Plant found at the Graphite deposit in Mica-schist, at Worcester, Mass.—American Journal of Science, Vol. XXIX., p. 157, Feb., 1885.

Prof. Ch. H. Hitchcock, in 1860, have clearly established the fact that there extends from the vicinity of Worcester, Mass., to the southern extremity of Rhode Island, a more or less broken belt of rocks of Carboniferous age; and these writers all concur in describing these rocks as materially different from those of the best known coal fields. Instead of Bituminous coal or of Anthracite, we find there a plumbaginous Anthracite; instead of the accompanying clays and clay-slates, we find clay-slates and Mica-schists. The southern portion of the belt, at least, is traversed by numerous Quartz veins, and all the rocks and minerals of the region indicate varying degrees of metamorphism. During the last few years the writer has devoted considerable time to the construction of a geological map of the vicinity of Newport, R. I., and of a geological section across the entire basin, which at that point measures some fifteen miles in width. Since the publication of the results of this work, in extending during last summer the observations northwards, I came upon a locality where the metamorphism of the coal-measures had proceeded further than it is supposed to have done even in that region. The object of this paper is to give a brief statement of these observations.

[In order, however, to show their general bearing the following condensed summary of the writer's former papers on the stratigraphy of the vicinity of Newport is here given.* On either side of the basin we have areas of Protogine and Gneiss (A), and in the centre two isolated masses of stratified Protogine. Closely allied to this we have on the west side of the basin a long strip of Mica-schist (B), some of which contains rounded quartz pebbles, and is traversed both horizontally and vertically by veins of Granite. Not far from the juncture of the Gneiss and Mica-schist is a bed of granular Plumbago. A and B may be of Montalban or even of Huronian age. Then follow certain beds of Hornblende, Chlorite and Mica-schist (C), and of Epidote and Chlorite-schist (D), which may be synchronous. A series of strata similar to C, and probably of Silurian age, occurs in Connecticut.†

The next series (E) consists of Chloritic Argillytes with passages of Calcite, nodules of Jasper and some thick layers of Dolomite. Its age is doubtful.

* A contribution to the Geology of Rhode Island. Proceedings of the Boston Society of Natural History, Vol. XXII., Jan. 3rd., 1883. A contribution to the Geology of Rhode Island. American Journal of Science, Vol. XXVII., March and April, 1884. (In the Section on Pl. VI. of this paper the unconformity between the Coal-measures and the Protogine should probably have been represented rather as a thinning out of the Coal-measures in contact with Protogine beds of originally conformable stratification.) Remarks on some of the evidences of Geological disturbance in the vicinity of Newport. Proceedings of the Newport Natural History Society, 1883-4.

† See James D. Dana, On Rocks of Helderberg Era in the Valley of the Connecticut, etc. American Journal of Science, Vol. VI., p. 339, 1873.

Prof. T. S. Hunt, of Montreal, is disposed on chemical and lithological grounds to assign both this and the following to the Huronian. The next is a Siliceous Argillyte (F) passing into an impure Serpentine, with, however, some seams of Talc and Precious Serpentine. The relative age of this and the preceding series is difficult to make out. However, together with fragments of A, C, and E, it seems to have constituted an island some four miles in diameter in the midst of the Carboniferous marsh or estuary. All the rocks described above are presumably of Pre-Carboniferous age, and upon the different members of this series, for they do not seem to have been uniformly deposited, the Carboniferous rocks were laid down. The lowest bed of Carboniferous age is a conglomerate of fine Quartz pebbles with some argillaceous matter, metamorphosed into a dark, compact, siliceous rock, containing here and there a layer of black slate with *Annularia longifolia* (G). This probably belongs to the "Millstone Grit." The overlying bed is a Sideritic Argillyte (H)—a finely laminated slate generally with minute nodules of carbonate of iron with a crystalline structure. Then a thick bed of coarse conglomerate (I), the pebbles and boulders of which consist of a micaceous Quartzite, and contain in some localities Lingulæ. Minute crystals of Magnetite abound in the cement of this conglomerate. The pebbles are often coated with scales of Mica, and the shells of the Lingulæ are sometimes plumbaginous. Lastly, we have the Coal-measures proper consisting of alternating conglomerates, sandstones, clay slates and Mica-schists, together with several seams of plumbaginous Anthracite (J). About sixty species of coal plants occur in the slates of this series—mainly of the genera: Annularia, Calamites, Lepidodendron, Neuropteris, Odontopteris, Pecopteris and Sphenophyllum. The impressions are sometimes coated with Talc or Pyrite. The latest analysis of this coal* afforded the following extremes in nine analyses: Carbon 67—79 %, Ash 11—17 %, Volatile combustible 4½—7¼ %, Water 2¼—10¼ %. The Ash contains from 50—75 % of Silica. This coal, as stated by Dr. Emmons, possesses the property, after being dried at 115° Centigrade, of absorbing, when exposed to a N.W. wind, over 13 % its own weight of water, and, when placed over water, 22½ %. Veins of Quartz and of Asbestus traverse the coal seams.

The Pre-Carboniferous beds measure at least from 4,000 to 7,700 feet, the Carboniferous from 4,000 to 5,500, and in other parts of the basin perhaps 8,000 feet. All the beds have been folded parallel to the Appalachian chain, and the last flexure probably took place at the close of the Carboniferous Period. The beds were also flexed, though on a much smaller scale, in the opposite direction, indicating a pressure operating N.N.E.—S.S.W., as well as one W.N.W.—E.S.E.]

In the western part of the basin, along the West Passage of Narraganset Bay, the strata of the Coal-measures are much disturbed, being in places vertical or folded over upon themselves. In accord-

* Arthur B. Emmons, Notes on the Rhode Island and Massachusetts Coals. Transactions of the American Institute of Mining Engineers, Sept., 1884.

ance with the geological law that regions of the greatest disturbance are generally those of the greatest metamorphism, it is not strange that the rocks of the West Passage are more metamorphic than those of other portions of this section of the basin. On the west shore of the Island of Conanicut the Coal-measures dip E.S.E. true, away from the west side of the basin, the nearest rocks to the west being the Mica-schist (B), which forms there the shore of the mainland. In examining the outcrops on the west shore of the northern portion of Conanicut, which, with occasional interruptions, extend some three miles or more, I noted the following section, beginning with the more recent strata :

Mica-schist with Garnets, Staurolite, Ottrelite and Chlorite, 4 feet.

Plumbaginous Argillyte, with minute veins of Mica and coal ferns, 3 feet.

Mica-schist with Garnets, Staurolite, Ottrelite and Chlorite (including 2 feet of Plumbaginous-schist), 10 feet.

Several layers covered, but conformable.

Mica-schist with Garnets and Chlorite (including a few inches of Plumbaginous Argillyte), $3\frac{1}{2}$ feet.

Quartzose Mica-schist (including 2 feet of Quartzyte with radiate Asbestus), 7 feet.

Plumbaginous Argillyte with Garnets and Chlorite, 2 feet.

Mica-schist with Garnets, Staurolite, Ottrelite and Chlorite, 8 feet.

The Staurolites occur as single crystals, twins of 60°, and drillings. The Garnets and Staurolites are generally partial pseudomorphs of Chlorite after Garnet or Staurolite.

If such highly crystalline Paleozoic rocks occur in one region they may elsewhere ; and it would not be surprising if some metamorphic rocks, now regarded as of Azoic or Eozoic age, should be ultimately found to belong to the Paleozoic.

The President, Messrs. Notman, Shaw and Livingston made some observations on the subject of the paper.

THIRD ORDINARY MEETING.

The Third Ordinary Meeting of the Session 1884-'85, was held on November 15th, the President, Prof. Ellis, in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges received since last meeting was read :

1. Science, Vol. IV., No. 92, for November 7th, 1884.
2. Transactions of the Linnean Society of New York, Vols. I. and II., December, 1882, to August, 1884.

The President, Prof. W. H. Ellis, then read his Inaugural Address :—

THE PRESIDENT'S ADDRESS.

This year will be marked in the scientific annals of Canada with a red letter. It has been rendered memorable by the visit of the British Association. Although a sober estimate of the effects produced or likely to be produced by this visit will in all likelihood fall short of what has been claimed by some enthusiasts, there can not be two opinions as to its importance. It marks an era in our country's development. We have shaken hands with our brethren across the sea, and the leaders of British science have recognized that we too are alive to the great work of the advancement of human knowledge, and not only willing but able to bear our part in it.

We may smile when we read in an English newspaper that "*in consequence* of the visit of the British Association to Canada twenty thousand dollars has been subscribed in Toronto to found a public library;" but for all that we cannot fail to acknowledge that, setting aside exaggeration, the results of this visit must be of great importance—how great it is impossible to estimate.

The meeting will have a two-fold influence—an influence on our visitors and on ourselves. As to the effect upon the members of the British Association who made the voyage to Canada, and many of whom spent several weeks in travelling over the length and breadth of our land, we are scarcely in a position to speak, although we may feel confident that the intercourse that they have had under very favourable circumstances with a people of their own race—one with them in language, in religion, in allegiance, and in laws—

and yet exhibiting here and there those slight, often indeed indescribable, although readily appreciable, differences which inevitably follow the separation of a people from the parent stock cannot have been without interest. Interesting, too, must have been the spectacle of a race of Frenchmen, in whose past the Great Revolution has no place, to whom Voltaire is but a heretic, and to whom Napoleon is but a name of history—a people who unite with the shrewdness, the thrift and the lightheartedness of the Frenchman of to-day the simple faith of the Breton peasant of the middle ages.

As for the country itself, although the rawness unavoidable in a new country always produces an unpleasant effect upon those whose tastes have been formed in a land where the details have been wrought out by the labour of generations, and all unsightliness has been smoothed and toned away by the mellowing hand of time, yet there is such plain witness of wholesome strength, of plenty in the present and promise for the future, that the thoughtful visitor can well forgive faults which will be surely cured by time, and which time only can cure. But the exceeding loveliness of our woods and our waters may well atone for much that is crude and displeasing in our towns and settlements. Here one can praise without stint or qualification, if praise were not out of place among scenes where the fitting frame of mind is rather one of abandonment to the sweet influences of nature, and criticism, even in the form of the most appreciating commendation, seems to jar upon the ear.

It is always interesting to know how we seem to others. The American wants to see himself through English spectacles, and the Englishman is greatly interested in reading how he looks to a Frenchman. So we are naturally curious to find out how we appeared to our late guests. But, leaving this side of the question, the Montreal meeting ought to have, and will have, important influences upon ourselves. We have been brought into personal contact, or at least we have looked into the faces and listened to the voices of many of the foremost men of our race and time in every department of science. Names which to most of us were before but names have become living flesh and blood. Thinkers and investigators with whose minds, so far as they were set forth in their writings, we have long been familiar we have found to have not only minds but bodies. Henceforth they will be to us more than mere vague abstractions. They will have a living human person-

ality, and our interest in their writings and in their work will be keener and more vivid.

To the student of science the value of this personal intercourse with those who have done and are doing great and lasting work is incalculable. It rouses his enthusiasm. It stimulates his ambition. It stirs his flagging energies, and wakes in his breast the aspiration to share with them, even if only in an humble way, the glorious work of searching out the truths of nature and thinking out the thoughts of God. It lifts him out of himself and the little circle of his own interests and cares and makes him feel himself a citizen of the great Commonwealth of Science—a soldier of the great army of workers whose aim is the discovery of truth.

The project of holding a meeting of the British Association in Canada was a bold one; and there were not wanting prophets of evil who, when it was first set on foot, were ready to throw cold water on it, and call it inadvisable if not impracticable. The length of time taken in going and returning, the discomforts of a long sea voyage, and the expense, would, it was said, prevent all but a few daring enthusiasts from taking part in it. It was feared also that the number of those in Canada who took enough interest in science to assist at the meetings would be small, and that only failure and disappointment would result from the attempt. Even if tempted by the inducement of a cheap excursion any considerable number of people could be induced to make the voyage, those whose presence would be most desirable on such an occasion would be absent, and if quantity was forthcoming quality would most certainly be inferior.

It is gratifying to know, as we do now, that these predictions were entirely groundless. In every respect the Montreal meeting of the British Association was a most successful one. The numbers attending the meeting were beyond all expectation; and these were not mere holiday seekers, but those really interested in the objects of the Association. The number of old annual and life members who attended the Montreal meetings was above the average.

The interest of the meetings of sections was also all that could be desired. The papers read, both as to number and character, were decidedly above the average, and the interest shown by the Canadian public was most satisfactory. In every respect those who planned and carried out the undertaking on both sides of the Atlantic have every reason to congratulate themselves upon the success that has

crowned their endeavours. An experiment so successful will bear repetition; and in all probability some of us here to-night will have the pleasure of welcoming on some future occasion the members of the British Association to our own City of Toronto.

The British Association is now a little more than half a century old, having been established in 1831. The idea seems to have originated with Sir David Brewster, and to have been suggested to him by a German Science Congress, instituted eight years previously. The first meeting of the British Association was held at York, and the objects stated were :—

1. To give a stronger impulse and a more systematic direction to scientific enquiry.

2. To promote the intercourse of those who cultivate science in different parts of the British Empire with one another and with foreign philosophers.

3. To obtain a more general attention to the objects of science and a removal of any disadvantages of a public kind which impede its progress.

It is the latter object which is, perhaps, the peculiar distinction of the British Association. While other learned societies are either select philosophical clubs or associations of those interested in some special branch of science, the British Association is catholic in constitution and appeals directly to the public. It demands in its members no literary acquirements, no special scientific attainments, no other qualifications, in fact, than such a degree of interest in science as is shewn by the payment of its fees and the attendance on its meetings. It is not like the Royal Society, for example, a body of men eminent in their respective pursuits, into which entrance is strictly guarded, and whose membership is looked upon as a coveted honour comparable with that conferred by an order of knighthood. It is rather an Association of all those interested in the progress of science willing to aid in its advancement or anxious to learn its condition.

But, though it thus addresses itself to the people and welcomes all who care to come to its meetings, it has always numbered among its members the very brightest names on the roll of British Science, and to this fact it owes alike its dignity and its usefulness. In this respect, as in others, the late meeting has been well up to the mark,

as the names, which will at at once occur to all of us, abundantly shew.

The popular character of the objects and constitution of the British Association is highly typical of the modern philosophy as distinguished from the ancient, or at any rate, from the mediæval. The old philosophers were cloistered recluses, living apart from their fellows, and hiding their knowledge from the vulgar, or only displaying it to dazzle or to scare. Their works were not only written in a tongue unintelligible to the many, but were couched in language studiously obscure—a mystical jargon only understood by the initiated. Nowadays, each new discovery is at once communicated in clear and precise language, not only to those whose training has fitted them to understand the technicalities of science, but also so far as possible to the public. Indeed, many of the most gifted masters of experiment and research have in late years expended almost as much pains and labour in the popular exposition of the results of their investigations as they devoted to the investigations themselves. No sooner, too, has a new truth been discovered or a new law been established than a hundred acute minds are ready to seize upon it and turn it to practical utility—discovery and invention go hand in hand, and the door of the laboratory opens into the workshop.

It is in Italy that the germ of scientific associations first began to sprout, but England was not far behind, and there more than two centuries ago a little knot of earnest workers banded themselves together to form a Society the fame of which was destined to spread over the world, and on the model of which all subsequent scientific societies have been more or less constructed—the Royal Society of London, for the Promotion of Natural Knowledge.

The first President was Sir Robert Moray. The Society was soon incorporated under Royal Charter, and in 1663 a new charter was granted which is still the fundamental constitution of the Society. The first President under the new charter was Lord Browncker, the Chancellor to the Queen, and a mathematician of eminence, and among the members of the council appears the venerated name of Robert Boyle. Two years later appeared their first number of "Philosophical Transactions," as the papers published under the auspices of the Royal Society are still called, and the year 1671 was made memorable by the admission to the Fellowship of the Society of a young professor of mathematics, of Cambridge, who was destined

to shed immortal lustre on the Society and on his country, under the name of Sir Isaac Newton. At a meeting held on the 28th of April, 1686, Newton presented his Principia, which, however, the Society had not funds to publish, its resources having been exhausted by the recent publication of a treatise on fishes.

But time would fail me to speak of Cavendish, of Davy, of Franklin, of Priestly, of Wollaston, of Brewster, of Buckland, of Faraday, of Herschel, and of a host of others who, from its foundation to the present day, have contributed to make famous the Royal Society of London.

So far as the object of its founders was concerned, the Promotion of Natural Knowledge—the encouragement of investigation and research—the Royal Society was nobly fulfilling the hopes that were entertained of it, and the expectations of its friends. But in order that a nation may advance in science it is not enough that it has philosophers, it is necessary that the results of the labours of its philosophers should be communicated to the nation at large, and that the public should be educated up to be able to understand and appreciate them. As yet there was no provision for this. But with the hour came the man. This man was Benjamin Thompson, better known by his title of Count Rumford, a name familiar to everybody, although of the man himself much less is generally remembered than his merits deserve. It may not be familiar to all of us that his title is derived from the New Hampshire village in which he was born in the middle of the last century, a village then called Rumford, but now known as Concord. His youth was that of a typical Yankee boy. He took a keen interest in chemical experiments, and although the Fourth of July had not yet been invented, he blew himself up with fireworks before he was sixteen. He served as clerk in a dry goods store in Boston, taught school, and, at the age of twenty, married a wealthy widow, and became a major of militia. At this juncture the Revolutionary War broke out and Thompson took the King's side. Sent with despatches to England he found favour in influential quarters, received a public appointment, and, returning to his youthful tastes, began a course of scientific investigations, and was elected a Fellow of the Royal Society. He made a friend of Hardy, and all through the campaign of 1799 he was on board the *Victory*, making experiments in gunpowder. We next find him Colonel of the King's American Dragoons, at the head of which he served with

courage and distinction, and high in the friendship and confidence of Sir Guy Carlton. On the reduction of his regiment, subsequent to the close of the war, he went to Vienna to serve with the Austrians against the Turks. But the expected hostilities not taking place he entered the service of the Elector of Bavaria as Colonel of Cavalry and Aide-de-camp General. He devoted himself to physical researches and to the inauguration of reforms of all kinds, economical, political and military. Honours were showered upon him. He became Lieutenant-General of the Bavarian armies, a Count of the Holy Roman Empire, and was decorated with the order of the White Eagle. But, with all his manifold employments, he found time to pursue his scientific investigations, and was made a member of the Academy of Sciences of Berlin and of Bavaria. Returning for a while to England he read before the Royal Society in 1798 his remarkable paper "on the source of the heat which is generated during friction." While superintending the boring of cannon in the arsenal at Munich he was struck by the heat produced, and led to construct a special boring apparatus, by means of which he succeeded in making water boil. The paper is a description of these experiments, and contains the pregnant idea, expressly stated, that heat produced in this way could not possibly be a material substance—could not, indeed, be readily conceived as anything other than motion. Anxious to introduce into England those reforms with reference to the condition of the poor which he had endeavoured to inaugurate abroad, he set on foot, among other schemes, an institution "for the diffusion of scientific knowledge, and for the teaching of the application of science to the useful purposes of life." The outcome of this was the Royal Institution. Rumford was greatly interested in the economical applications of fuel. He had done a great deal in this direction in the kitchens of several public institutions in several parts of Europe; and one of his leading ideas with reference to the new institution was the exhibition of models of fire-places, stoves, boilers, as well as houses, bridges, spinning wheels, and such other machinery as the managers should deem worthy of public notice. In addition to this, a lecture-room was to be fitted for philosophical lectures and experiments, and a laboratory established and furnished with all the necessary apparatus for chemical and physical investigation. The instituion began its life with the present century, and the chair of Chemistry was soon filled by a young Cornish chemist,

Humphry Davy, then only in his twenty-third year. The extent of his attainments, the originality of his ideas, and the fluency of his delivery, combined, perhaps, with his youth and good looks, took the London world by storm. The Royal Institution became the fashion. The gay world crowded to Davy's lectures, and Rumford's boilers and soup-kitchens were elbowed out of the way. The chair of Natural Philosophy was filled by Dr. Young—that extraordinary genius who added to his brilliant mathematical attainments, not only the command of nearly all ancient and modern languages, and a knowledge of botany of no mean order, but also remarkable proficiency in music, and, what is certainly not common among professors of Natural Philosophy—wonderful skill and daring as a circus rider. He was soon succeeded, however, by Dalton, who described his new colleague, Davy, as a "very agreeable and intelligent young man, whose principal defect as a philosopher was that he did not smoke!"

Men like these were sufficient to establish the renown of the Royal Institution; and the names of Faraday and Tyndal, who succeeded them, are enough to show that they found worthy successors.

As an exponent of science the Royal Institution addresses itself almost exclusively to the upper classes. Rumford's projects have been to a large extent carried out by another institution, in whose foundation he had no share—the Society of Arts.

Rumford himself soon returned to Bavaria, where he only remained a short time, and spent the closing years of his life in great retirement in Paris. He seems to have made few friends among the Parisians, partly because of his peremptory and unyielding disposition, and partly because of his eccentricities. Among the latter was his habit of wearing in winter a white coat and hat in order to reduce the radiation of heat from his body to a minimum.

At the time of the foundation of the Royal Society the scope of natural knowledge was so limited that one society was sufficient to include all those who pursued scientific research; and yet, as early as 1664—that is the year after the society received its amended charter—eight committees were struck for the purpose of furthering investigation in different directions. As, however, the number of known facts in each branch of science increased, and the field for further investigation opened out *pari passu*, while the number of special workers was also rapidly multiplied, one society was no

longer able to include all the work, and various special societies one after the other began to spring into vigorous life.

The Society of Antiquaries was chartered in 1751.
The Society of Arts was founded in 1753.
The Linnæan Society was founded in 1788.
The Geological Society in 1807.
The Royal Astronomical Society in 1820.
The Zoological Society in 1826.
The Royal Geographical Society in 1830.
The Botannical Society in 1836.
The Microscopical Society in 1839.
The Chemical Society in 1841.
The Philological Society in 1842.
The Ethnological Society in 1843.

Besides these and other societies for the advancement of pure science, there are the various professional association : the Institution of Civil Engineers, the Medical and Law Societies, the Royal Institute of British Architects, and the Pharmaceutical Societies.

This, then, is a brief outline of the development of a few of the more important of the Learned Societies of England, which, together with hosts of others in other parts of the British Empire, in Europe, and in America, have done so much for the Promotion of Natural Knowledge. Let us now briefly consider what are or should be the aims of such associations, what are their proper functions, and how their objects may be best fulfilled.

I think all will agree that the first and most important function of Learned Societies is the publication of the results of investigation. It is before all things necessary to the growth of knowledge that the discoverer of a new truth should have the opportunity afforded him of making his discovery known as widely and as promptly as possible. It is most desirable that those engaged in research should have the fullest possible means of making themselves acquainted with what has been done by others, or, as the phrase goes, with the condition of our present knowledge of the subject. One truth leads to another; and each new fact observed, each new law established, suggests fresh fields for investigation, and furnishes new weapons to the armoury of science. *Vixere fortes ante Agamemnona.* There were philosophers before Newton, but, unless they had sufficient private means to publish their own works, or enough influence to

induce some wealthy man to do so for them, oblivion awaited them with far more certainty than any pre-homeric hero. For conquests remain if the conqueror's name is forgotten; but a discovery unpublished is lost to the world. But, all-important as they are, it unfortunately happens that even in times of the greatest intellectual activity, and among the most highly cultivated people, the records of original research, even of the most brilliant character and upon the most momentous subjects, can never command a remunerative market. They must be published at a pecuniary loss. The number of those whose training enables them to follow intelligently the technicalities of such a paper is necessarily limited, and the number of those whose interest in the special subject under consideration is sufficient to induce them to master the tedious details of experiment and induction by which the conclusion is reached is usually still more limited. Moreover, such publications are often very expensive. Carefully executed drawings of apparatus or natural objects, machinery or anatomical details, diagrams and mathematical formulæ, combine to render them in many cases exceedingly costly. And, since the author can seldom hope for any pecuniary advantage from them, while he has usually already expended much valuable time, and often also money in the research itself, without any expectation of profit or reward, it is not only most desirable, but it is an act of bare justice, that the expense of publication should be shared among those interested in the subject of the investigation; and indeed frequently but for channels so offered most valuable investigations would either never see light or would be published in such an inadequate way as to lose half their value.

Herein lies the immense public benefit of the published Transactions of Learned Societies. By means of them any one who does work worth recording has an opportunity of publishing his investigations free of cost; and knows that when he does so his work will be immediately placed in the hands of all those likely to take an interest in it, and capable of appreciating it at its proper value. So, too, the student who wishes to keep abreast with the march of knowledge has only to read the Transactions of the Learned Societies to learn all that is being done in his special line of study.

Another object of scientific associations is to promote intercourse among those pursuing similar lines of research, and indeed among those engaged in the cultivation of science in any of its departments.

This also is a highly important function. The stimulus derived from the impact of mind upon mind, whereby ideas are often generated like sparks from flint, is proverbial. Personal contact, too, with men distinguished in any branch of science has a wonderfully stimulating effect upon the younger students of the same branch; and experience abundantly shows that in science as elsewhere it is not good for man to be alone. The reading of a paper in such a society is usually followed by a discussion in which those whose special studies have rendered them familiar with the subject of which the paper treats join, and, with an audience understanding the subject and capable of fairly criticizing the paper, this discussion is often as valuable as the paper itself.

Again, science is now so vast that it is wholly out of the power of any man to master it all. Hence the division of labour. Hence the separation of Human Knowledge into separate sciences. But after all these divisions are not hard and fast lines. Each science so called is dependent more or less upon its fellows; and each contributes its share to the others. Chemistry cannot do without Physics, and Biology cannot do without Chemistry, while Geology is an application of all three to the study of the earth's crust. There are, therefore, advantages of no mean order in the facilities afforded by learned societies for the intercourse of students of different branches of science with one another.

The social element then, as we may call it, is an important factor in the influence of Learned Societies upon the advancement of science. But science does not exist only for the scientific. It is a most essential condition to its exercising its due influence upon the world that its discoveries should be disseminated among mankind at large. And this propagation of knowledge is another most important function of Learned Societies. We hear much now-a-days of popular science, and the phrase as sometimes understood has a rather questionable signification. Too often those who have undertaken to enlighten the people in scientific matters have been sadly unfitted for their self imposed task. The spectacle of a man with only the merest smattering of a subject endeavouring to teach those whose ignorance is only less than his own is not an edifying one. Unfortunately it is not a rare one. The shallow pretender who seems to think that any knowledge that goes beneath the skin of the subject would only be an incumbrance likely to hinder his glib and self

satisfied deliverances has done much to bring science into disrepute. It cannot be too strongly urged that no man can teach what he does not know. Self evident as the proposition seems, experience constantly shews that it is in danger of being ignored.

With some again popular science is another name for scientific fooling. They seem to think that the popular stomach is unable to digest anything but froth. "Strong meat is for men and milk for babes," but these people feed their scientific infants not on good wholesome milk, but on sugar plums and curry powder. Their children cry for bread and they give them a Pharoah's Serpent!

None the less, however, is it a matter of the highest moment that sound scientific instruction should be given to the public, that the truths laid hold of by the few should be made known to the many, that science should be no esoteric possession of the favoured few, but should become the heritage of the world.

The vastness of the practical benefits which the application of scientific discoveries and scientific principles to practical life has brought in the past, and is likely to bring in the future, is one most cogent reason for the more general dissemination of these discoveries and principles.

If we try to picture to ourselves the condition of society at the end of the 17th century, when Savery exhibited before the Royal Society a model of his engine for Raising Water by Fire, and compare it with that with which we are now familiar, when the great agents of Heat, Light and Electricity have been brought by the aid of science into such wonderful subjection to the wants of mankind; and if we try to pierce with prophetic vision into the mists of the future, and speculate upon the gigantic possibilities which the light of science, brightening every hour, seems to render visible before us, we may well be impressed with the necessity of disseminating a knowledge of science as a means of benefiting the human race.

But besides the practical advantage to be derived from the spread of scientific information, it has a highly important reflex action upon the scientific investigator.

Man will not work without a motive, and the applause of a discriminating public is one very strong incentive to exertion in science as in every other field of labour. It is true that some men love knowledge for its own sake, and that the most successful workers are likely to be those who are enamoured of their labour. But for

all that, there can be no doubt that a sympathetic appreciation of his work is a most grateful and effectual stimulus to the scientific investigator, and in most cases beyond the pleasure that his labour itself brings, it is the only reward he can have or hope for.

Now the amount of sympathy and appreciation that a scientific investigator gets is in direct proportion to the number of his fellow men who are capable of understanding his work, and whose tastes are cultivated sufficiently to awaken in them an intelligent interest in it. Here, then, we have another cogent argument in favour of the importance of the diffusion of scientific knowledge among the people.

Then scientific investigation costs money. It demands, in the first place, leisure on the part of the investigator. Then the apparatus required in exact researches is frequently most expensive, and is every day becoming more so. The time has gone by when discoveries which revolutionize science can be made with a few glass bottles and a pair of apothecary's scales. To do good work instruments of the greatest refinement and delicacy are absolutely necessary, and such instruments are not to be had for nothing. In many cases the apparatus used for a particular research is of no further use when that research is completed, and becomes of merely historic value. Then there is publication, the cost of which we have already considered. Again, a philosopher is not born but made. True, nature must do her part, but what would avail the genius of a Newton or of a Lavoisier if—

> "—— Knowledge to their eyes her ample page,
> Rich with the spoils of time, did ne'er unrol,
> Chill penury repressed their noble rage,
> And froze the genial current of their soul."

The man who is to accomplish anything in science must have a scientific training, and a scientific training means laboratories, lecture rooms, apparatus, books and instructors, and here again the question of cost stares us in the face.

Now, science is never self-supporting. The application of science to the arts is often extremely profitable. The cultivation of pure science is never so; yet upon this cultivation of pure science all the applications of science directly depend. It is then adsolutely necessary to the advancement of science that scientific institutions of various kinds should be supported by generous donations either from the

public funds or from private munificence. Without liberality in this respect there can be no scientific progress.

Now it is obvious that private contributions to scientific objects can only be looked for in a community among which a knowledge of the importance of science and of the needs of science is prevalent. So, also, no considerable grants of public money for scientific purposes can be expected unless those who control the public purse are impressed with the importance of science from a national point of view. In a free country the public purse is controlled by the people themselves, and it is self-evident that the most likely way to impress them with the importance of science is to disseminate among them a knowledge of its facts and principles. A sound and liberal popular scientific education is indeed the only way to ensure an enlightened public support of scientific institutions and a proper public recognition of the claims of scientific investigators.

A great scientific discoverer is an expensive product. As thousands of eggs are laid for every trout that arrives at maturity, so it takes a thousand embryo philosophers to produce one Newton. It is well, then, that public attention should be directed to science in order to incite promising youths to acquire a scientific training, and thus qualify themselves to follow scientific pursuits.

These then, I take it, are the objects and functions of a scientific association :—

1. To publish transactions ;
2. To afford opportunity for intercourse among scientific men, and
3. To assist in the diffusion of scientific knowledge among the people at large.

How may they best be accomplished ?

With regard to the first I have nothing to say. The form of the transactions must be left to the exigencies of each individual case.

As for the third head, viz., the diffusion of scientific knowledge, there are two ways in which it seems to me that a scientific society can promote this object : —

First, the very existence of an active society of this kind in a community is a kind of scientific mission continually winning converts to the cause of scientific study, and inciting them by precept and example to keep themselves abreast with advancement of knowledge. By reading papers and by discussion scientific culture is promoted among the members, and by a library and reading room

an opportunity is given them to acquaint themselves with what has been done and what is doing in all departments of science.

Secondly, an important method of attaining this object is by means of public lectures upon scientific subjects delivered by competent persons.

These lectures should be suited to a popular audience, in so far that they should assume no profound knowledge of the subject on the part of the audience, and hence should avoid unexplained technicalities. But they should not be "popular" in the sense alluded to previously of conforming to the (generally erroneously) supposed popular taste for the sensational and the trifling to the exclusion of the useful and the solid.

A popular scientific lecture, which is really popular and really scientific, is an excellent thing, and well deserving the encouragement of a Learned Society.

Intercourse among the members is promoted formally by papers and discussions, and informally by affording a common meeting place and common interest for those engaged in scientific pursuits.

Much of the value of a society from this point of view will depend upon the interest shewn at its meetings and the character of the papers read. And here a society of general scope, such as our own, is placed at a marked disadvantage as compared with one which addresses itself to the cultivation of a special branch of science.

The reader of a paper before a mixed audience, such as the members of such a society, is placed between the horns of a dilemma. He must either adapt his discourse to the audience generally, and thereby make himself tedious to those whom he particularly wishes to interest, while he will be compelled to omit much of what would be of special value to those who understand the subject of his paper. Or he must address himself to those who have made his department of science their peculiar study, and thereby render himself unintelligible to nine-tenths of his audience.

There are a hundred little points of detail which are of the keenest interest to those actually working in any branch of science but which are not the slightest consequence to anyone else. The discussion of such points as these gives life and interest to a meeting of specialists, which can not be attained elsewhere. From these and similar considerations, as well as from the mere demands of time and space, the various special societies have in England come to monopolize the

greater part of the work which the Royal Society originally undertook, while that body reserves to itself the consideration of questions involving the general principles of science and leaves matters of detail to the special societies for the cultivation of the different branches of science. Yet, in the Royal Society itself, the principle of division of labour is by no means neglected. As early as 1664 eight committees were formed for the purpose of promoting the propagation of natural knowledge in different directions. With some few modifications these committees still exist and form part of the machinery of the Society. These committees comprise :—

Mathematics, Astronomy, Physics and Meteorology, Chemistry, Mineralogy and Geology, Botany and Zoology.

Each of these committees has its own chairman and secretary. The Royal Society of Canada, a body fashioned to some extent on the lines of the Royal Society of London, although in other respects it rather follows the model of the French Academy, is divided into sections with special officers, each charged with the care of certain allied subjects. The British Association is similarly divided into sections as follows :—

A.—Mathematical and Physical Science.
B.—Chemical Science.
C.—Geology.
D.—Biology.
E.—Geography.
F.—Economic Science.
G.—Mechanical Science.

The American Association has a similar division as follows :—

A.—Mathematics and Astronomy.
B.—Physics.
C.—Chemistry.
D.—Mechanical Science.
E.—Geology and Geography.
F.—Biology.
G.—Histology and Microscopy.
H.—Anthropology.
I. —Economic Science and Statistics.

Now, it seems to me that some such divisions might with great advantage be introduced into the Canadian Institute, and I would venture to suggest for your consideration the outlines of such a

scheme. If the idea should be favourably received details can be considered at leisure, and the plan modified as seems best.

Briefly, then, I would suggest the establishment of say four sections as follows :—

A.—Mathematics, Physics and Mechanics.

B.—Chemistry, Mineralogy and Geology.

C.—Biology.

E.—Ethnology, Philology, History and Economy.

Each of these sections should have its own chairman and secretary, who, with the officers of the Institute, might constitute the general council.

Each section might meet once a month, and whenever there was a paper of sufficiently general interest to merit its being read before the whole body of members, a general meeting of the Institute might be held.

I am fully aware that the division that I have suggested is far from a philosophical one, and I am in no way wedded to any of the details of the scheme. All I ask is that the members of the Institute will give the matter their consideration, and if it seems to them that the change will be likely to have the effect of arousing more interest in the meetings of the Canadian Institute and of furthering the objects that we all have at heart, then I shall be happy to adopt any modification that the Institute think best, and I will gladly co-operate in giving such a scheme a fair trial.

FOURTH ORDINARY MEETING.

The Fourth Ordinary Meeting of the Session 1884-'85, was held on Saturday, November 22nd, the President in the Chair.

The minutes of last meeting were read and confirmed.

Donations and Exchanges received since last meeting :

1. The Canadian Entomologist, Vol. XVI., No. 8, August, 1884.
2. Monthly Weather Review, October, 1884.
3. Monthly Health Bulletin of Ontario, September, 1884.
4. Science, Vol. IV., No. 93, November 14th, 1884.
5. Transactions of the American Society of Civil Engineers for September, 1884.
6. Memoirs of the Boston Society of Natural History, Vol. III., No. 10 May, 1884.

7. Monthly Notices of the Royal Astronomical Society, Vol. XLIV., No. 9.
8. Proceedings of the Royal Geographical Society, N.S., Vol. VI., No. 11, November, 1884.

The following gentlemen were elected members of the Institute:

W. S. Milner, B.A., Dr. T. Walker Simpson, William McCabe, Esq., Geo. H. Jarvis, Esq., Robert Winton, Esq.

Mr. W. A. Douglas then read a paper on

WAGES.

The current doctrines respecting the distribution of wealth are very contradictory, and still require much investigation. Mill's doctrine of wages has three assumptions:

1. Wages are drawn from capital, that part thus devoted being called the wage-fund.

2. Average wages may be ascertained by dividing the wage-fund by the number of labourers.

3. Wages can be increased only by increasing the numerator or diminishing the denominator.

Therefore, if wage-fund be 10, labourers 5, wages will be $\frac{10}{5} - 2$, and if labourers be increased to 6, wages will full to $\frac{10}{6} = 1\frac{2}{3}$.

The following are a few of the objections of this doctrine:

1. An additional labourer will receive employment only on condition that he produce 2 + something, that something being enough to cover profit and rent. The additional labourer will increase not merely the denominator but also the numerator.

2. It is illogical, Mill teaches that capital is one of the component forces, wealth the resultant; wages, rent and profits, the division of the resultant. He is, therefore, illogical in calling capital a component force and also a resultant.

3. This doctrine teaches a wrong perspective of society. It represents the capitalist as the initial party in production, supporting the labourer, and the latter as the dependent party; whereas, in fact, the capitalist and labourer are co-workers, mutually dependent, working concurrently to obtain wealth, and when the wealth is produced, then dividing the product.

The study of political economy presents two distinct questions:

1. Given a number of labourers and a certain quantum of natural forces; what will be the product?

2. Given a certain product, what quantity will go to the landowner, the capitalist, and the labourer? This is the question to be solved that we may determine wages.

Ultimate analysis will show that the division of the product is either for land or for labour.

To determine the distribution of the product we must have regard to the following considerations:

1. Competition of labourers amongst themselves. Labourers are moveable, hence within areas in which competition is effective, wages are equal among labourers of the same class.

2. Competition of landowners amongst themselves. Land is immovable, hence the values differ enormously, all the way from nothing in rural districts to fifty or one hundred thousand dollars per acre per annum in cities.

3. Competition of labourers against landowners. Labourers increase, land does not. Increase of labourers increases their competition, rents rise at the expense of wages.

4. Relative power of landower and labourer in determining a bargain. Labourers must have access to land or die; this dependence is absolute. The dependence of the landowner is determined only by the necessity of maintaining the labourer alive. Hence unskilled labour has ever had to be content to accept a bare subsistence. The fulcrum is placed so that the advantage is altogether with the landowner. Strikes, as at present conducted, do nothing to remove that fulcrum in favour of the labourer.

Mr. Murray criticized the principles advanced by Mr. Douglas, contending that rent had not increased but diminished; that wages had not diminished this century, and that the rich are not becoming richer and the poor poorer. He declared that wages must be a matter of free agreement between employer and employé.

Dr. Bryce questioned the statement that the amount of wages earned, when land produces no rent, is the measure of the wage-fund.

Mr. Browning controverted the position that wages diminish as wealth and population increase, and that the statistics show the contrary.

Mr. Livingston said labour and capital regulated themselves.

Mr. Douglas made a general reply.

FIFTH ORDINARY MEETING.

The Fifth Ordinary Meeting of the Session 1884-'85, was held on Saturday, November 29th, the President in the Chair.

The minutes of last meeting were read and confirmed.

Donations and Exchanges received since last meeting:

1. List of Publications of the Geological and Natural History Survey of Canada, 1884.
2. Science, Vol. IV., Nos. 94 and 95.
3. Transactions of the American Society of Civil Engineers for October, 1884.
4. The Journal of Speculative Philosophy, Vol. XVIII., No. 1, January, 1884.
5. Bulletin of the Museum of Comparative Zoölogy at Harvard College, Cambridge, Geological Series, Vol. I., Nos. 2, 3, 4, 5, 6, 7, 8 and 11, with Title page and Index to the Vol.
6. Bulletin of the Essex Institute:
   Vol. 15, Nos. 7, 8, 9, July to September, 1883.
   Vol. 16, Nos. 4, 5, 6, April to June, 1884.
7. Report of the Proceedings of the Sixteenth Annual Convention of the American Railway Master Mechanics' Association, held at Chicago, June 19th, 20th and 21st, 1883.
8. Transactions of the Manchester Geological Society, Vol. XVIII., Part I., Session 1883-'84.
9. Journal of the Quekett Microscopical Club, Series II., Vol. II., No. 10 November, 1884.
10. Journal of the Anthropological Institute of Great Britain and Ireland, Vol. XIV., No. 2, November, 1884.
11. Trübner's American, European and Oriental Literary Record, N.S., Vol. V., Nos. 9 and 10.
12. Minutes of Proceedings of the Institution of Civil Engineers, Vol. LXXVIII., Session 1883-1884. Part IV. Brief Subject-Index to Minutes of Institutions of Civil Engineers, Vols. LIX. to LXXVIII.
13. Correspondenz-Blatt der Deutschen Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, XV. Jahrgang, No. 9, September 1st, 1884.
14. Canadian Practitioner, December, 1884.

Mr. Thomas Robertson was elected a member of the Institute.

Captain Gamble Geddes, A.D.C., read a paper on

THE AFFECTION OF INSECTS FOR THEIR YOUNG.

The writer of this paper took the ground "that insects are capable of feeling quite as much attachment to their offspring as the largest quadrupeds. They undergo severe privations in nourishing them; they expose themselves to great risks in defending them, and even at the time of death much anxiety is exhibited for their preservation." This was not claimed for all insects, but in proof of the writer's contention the instances adduced were those of the common house-fly, the common white butterfly, the musquito, the gadfly, ichneumon flies, the ephemeridæ, the clothes-moth, the wild bee and the beetle.

Reference was made to the various expedients and artifices employed by these in suitable places upon which to deposit their eggs, with a view not only to the safety of the eggs themselves, but to the sufficiency of a food supply when the young reaches its perfect state.

In concluding his paper, the writer said:—"I have myself, upon many occasions, experimented with the dead bodies of frogs, and even with fish—all these are excellent baits to attract the species of our own Canadian burying insects—and I have enriched my collection with fine specimens many a time, after observing their habits sufficiently to be convinced that it is for the object of a future supply of food for the larva that the beetles undergo this severe labour," *i. e.*, the dragging and burying of the bodies of small animals.

Remarks were made by the President, Drs. Workman and O'Reilly, and Messrs. Macdougall, Murray, Notman, Livingston, VanderSmissen and Mowat.

SIXTH ORDINARY MEETING.

The Sixth Ordinary Meeting of the Session 1884-'85, was held on December 6th, 1884, the President in the Chair.

The minutes of last meeting were read and confirmed.

Donations and Exchanges received since last meeting:

1. The Canadian Entomologist, Vol. XVI., No. 9, for September, 1884.
2. Journal of the Franklin Institute for December, 1884.

3. Proceedings of the Asiatic Society of Bengal, Nos. 6 and 7, June and July, 1884.
   Journal of the Asiatic Society of Bengal, Vol. LIII., Part II., No. 2, 1884.
4. Mittheilungen der Anthropologische Gesellschaft in Wien, XIV. Band, 2 und 3 Heft.
5. Archivio per l'Antropologia e la Etnologia, Vol. XIV., Fascicolo Secondo Firenze, 1884.
6. Société des Ingénieur Civils, Séance du 7th November, 1884.

Mr. F. J. Garden and Mr. Herbert L. Bowman were elected members of the Institute.

Dr. Daniel Wilson read a paper on "The Bohemian Skull," which will appear in a subsequent fasciculus.

Messrs. Buchan and Bain made brief remarks.

A paper by Dr. Neil MacNish on "The Gaelic Topography of Damnonia," was read for the author by Mr. VanderSmissen.

THE GAELIC TOPOGRAPHY OF DAMNONIA.

I propose in this paper to examine the Topography of that portion of England which was at one time known as Dumnonia or Damnonia. For the sake of convenience it may be maintained that Damnonia embraced Devonshire, Cornwall, and the Scilly Isles. A writer in the *Encyclopædia Britannica* remarks that "Dumnonia or Damnonia, the Latinized name of a kingdom which long remained independent after the arrival and early conquests of the West Saxons, seems to be identical with the Cymric Dyfnaint, which survives in the present Devon. The Saxon settlers, as they advanced into the country, called themselves *Defenas*, *i. e.*, men of Devon or *Dyfnaint*, thus adopting the British name." Into *Dyfnaint*, *Devon*, the Welsh word *dwfn*, Gaelic *domhain*, seems to enter as a component part. Professor Rhys states, that the remains of the language of the Dumnonii in Devon and Cornwall leave no kind of doubt that they were of the earlier Celts or Goidels, and not Brythons. I am of opinion that satisfactory evidence can still be extracted from the names of rivers and bays and headlands in the ancient kingdom of Damnonia, to show that Celts, whose language was Gaelic, gave in the distant past many of those topographical appellations which, with various degrees of correctness, have come down to our own time. It may be safely affirmed that the names which were given in an early age to the streams and lochs and hills

and headlands of a country were intended to express some physical peculiarity. In his introduction to the "Vindication of Irish History" (p. 6), Vallancey thus writes: "It is unreasonable to suppose that the proper names of men, places, rivers, &c., were originally imposed in an arbitrary manner, without regard to properties, circumstances, or particular occurrences. We should rather think that in the earliest period, and especially when the use of letters was unknown, a name usually conveyed a brief history of the thing signified; and thus recorded as it were by a method of artificial memory." Dr. Bannister, the author of a Glossary of Cornish names, says "that Cornwall is a peculiar country. From its geographical position it may be called the first and last in England; and *one and all* good Cornishmen will maintain that it is also the best. Time was when Devonshire was part of Cornwall, with Exeter, it is thought, for its capital; which city was till the tenth century inhabited conjointly by Cornish and Saxons. The Cornish were driven across the Tamar by Athelstane; and it was declared death for one to be found east of its banks." It was about 930 that Athelstane thus violently compelled the Cornish to retire to the west of the Tamar. Devonshire, therefore, was much more strongly subjected to Saxon influences than Cornwall; and hence it may be expected, that the traces of Gaelic will be less distinctly and commonly marked in the Topography of the former than of the latter county.

The names of the rivers of Devonshire readily disclose their Gaelic origin, *e. g.*:

Teign, teth, hot, and *an, amhainn*, river. The *Tyne* of Haddington and Northumberland.

Dart, doirt, to rush, or pour out.

Plym, plum, to plunge.

The *Mew* and *Cad* unite to form the *Plym*.

Mew or *Meavy*: *magh*, a plain; or *meadhon*, middle.

Cad, cath, battle; or *cas*, rapid.

Tavy, Taw, tamh, quiet, *a* river. The Thames, Tay in Scotland, and Taff, Tave, Taw in Wales, come from the same root. *Tabh* in Irish and Scottish Gaelic signifies *water* or *ocean*.

Torridge, Tor, Tory: Into those names *torr*, a heap or round hill, clearly enters. *Torr* is a purely Gaelic word. It forms one of the expressive monosyllables which frequently occur in the poems of

Ossian. It is present in such words as Tormore, Torness, Torryburn, Torryline, Tory Island.

Avon, amhainn, a river.

Erme, ear, east; *amhainn*, a river.

Yealm, ealamh, quick.

Exe, uisge, water.

Culme, cul, back; *magh*, a plain. *Cul* occurs often in the Topography of Scotland, *e. g.*, Cullen, Culross, Culloden.

Creedy, criadh, clay.

Otter, oitir, a ridge near the sea, *Dunottar*.

Axe, uisge, water.

East Lyn, West Lyn, linne, a pool. *Linne* is present in such words as Dublin, Roslin, &c.

Barle, barr, a top; *liath*, grey.

Oare, odhar, dark-grey, sallow.

Mole, moyle, maol, bare.

Oke, oiche, uisge, water.

Yeo, Welsh *aw*, flowing, Gaelic, *a* water, resembles very strongly *Awe* in Argyllshire.

Bray, Braighe: height or upper part.

The names which have now been adduced are Gaelic, and occur frequently in the Topography of Ireland and Scotland, thereby enabling us to conclude that the same people who employed such words as *Teign, Avon, Tay, Awe*, &c., in connection with the streams and rivers of Ireland and Scotland, made use of the same words in connection with the streams and rivers of Devonshire.

Cum, valley or dingle; Cornish, *cwn*; Welsh, *coom, Coome, Coombe*; Irish, *cumar* or *Comar*, a confluence of waters, occurs repeatedly in the Topography of Devonshire, *e. g.*:

Lannacombe, lan, full.

Colcombe: caol, narrow.

Branscombe, bran, a mountain stream.

Dunscombe, dun, hillock.

Wiscombe, wis, usk, ouse, water.

Salcombe, sal, the sea or salt water.

Orcombe, oir, border.

Purely Gaelic words are thus found in combination with *cum*, a term which is found with little variety in Irish and Scottish Gaelic, and Welsh and Cornish.

So unmistakable is the Gaelic complexion of *Torr*, and so commonly is it to be found in the Topography of Ireland and Scotland, that were other evidences altogether wanting, the constant occurrence of it in the names of places in and around *Dartmoor* and elsewhere in Devonshire, might furnish a strong argument in favour of the contention, that Celts who spoke Gaelic must have occupied that part of England for some time at least during the early settlement of Britain. Were it to be maintained that *Dart* in *Dartmoor* is the Gaelic word *tart, thirst* or *drought*, a striking correspondence would be found between the very name and the sterile character of that region. *Moor*, the latter syllable of *Dartmoor*, bears a close resemblance to *mòr*, the Gaelic adjective for *great* or *extensive.* Thus interpreted, *Dartmoor* would signify *the extensive drought.* Nor can there be any difficulty in seeing how Dart, the principal river which issues from Dartmoor, and to which I have already assigned the derivation *doirt*, would bear the name of the region in which it rises, in spite of the incongruity that may attach to applying to any river of considerable magnitude a name that is indicative of drought or scantiness of water.

Crockern Torr is the name of a hill in the centre of Dartmoor, where the legislative business of the tin mines of Devonshire used to be transacted. *Crockern Torr, cnoc air an Torr*, the hill on the heap. The name is purely Gaelic, and the well-known word *cnoc* occurs in it.

In *Torquay, Torcross*, the word *torr* is present. Other names of places in Devonshire are of Gaelic origin, *e.g.:*

Carnmere, carn, a heap or pile of stones. *Kenton, ceann*, head; *dun*, a hillock. *Hamoaze, camus, chamus*, a harbour; *Culbone, cul*, back; *beinn*, a hill.

Beer, bior, water.

Ness, an eas, cascade.

Exbourne: uisge, water: *burn*, water. In such words as *Cudleigh, Leigh, Chumleigh—, liath*, grey or hoary appears.

The Topography of Devon, in spite of all the political changes that have passed over that county, and in spite of the different races that have inhabited it, preserves unmistakable reminiscences of Gaelic-speaking Celts, who must have been its earliest inhabitants of any permanence.

Isaac Taylor, in his "Words and Places," affirms that the word *Cornwall* or *Cornwales* signifies *the country of the Welsh, or strangers of the horn. Cornwall* may be regarded as a compound of *corn*, a Cornish word signifying *horn*, and *waller* a *stranger*. The origin of the term *corn* or *horn* may be discovered in the peculiar form of Cornwall, running as it does like a horn into the sea. *Cernow* is the Cornish word for Cornwall, and *Cernewec* and *Kernnak* for Cornish, *e. g., Metten da dha why: elo why clapier Kernnak:* good morning to you, can you speak Cornish? Max Müller, who has evidently bestowed great attention on the language and antiquities of Cornwall, thus writes in his "Chips from a German Workshop" (Vol. 3, pp. 242, 247): "The Cornish language is no doubt extinct, if by extinct we mean that it is no longer spoken by the people. But in the names of towns, castles, rivers, mountains, fields, manors and families, Cornish lives on and probably will live on for many years to come. More than four hundred years of Roman occupation, more than six hundred years of Saxon and Danish sway, a Norman conquest, a Saxon reformation, and civil wars, have all passed over the land, but like a tree that may bend before a storm but is not to be rooted up; the language of the Celts of Cornwall has lived on in an unbroken continuity for at least two thousand years." Norris, the editor of the ancient *Cornish Drama*, is of opinion that the Cymric was separated from the Gaelic before the division into Cornish and Welsh was effected, and that Cornish is the representative of a language once current all over South Britain at least. The author of the article on "Celtic Literature" in the *Encyclopædia Britannica* writes that "among the British dialects, the most archaic, *i. e.*, the one which best represents the British branch, is Cornish, which is the descendant of the speech of the unromanized Britons of England."

So very numerous are the Celtic words in the Topography of Cornwall, that, in his Glossary of Cornish names, Dr. Bannister asserts that there are 20,000 Celtic and other names. Owing to the difficulty as well as the uncertainty which must of necessity obtain in arriving at the true derivation of so many words, Bannister has with commendable modesty adopted as his motto the expressive language of Horace:—

"Si quid rectius istis
Candidus imperti: si non his utere mecum."

The names of the streams and rivers of Cornwall are to a large extent Gaelic, *e. g.* :—

Tamar, tabh, water ; *mor,* large.

Camel, cam, crooked ; *heyl, tuil,* flood.

Alan, geal, white ; *an,* river, *Gealan.* There is a river of the same name, *Allan,* in three counties in Scotland.

Lynher, linne, pool ; *hir sior,* long.

Looe, loch, or *luath,* swift.

Fal, foil, gentle ; *fal,* a circle.

Bude, buidhe (*?*), yellow.

Inny, innis, an island ; or *inne,* a bowel.

Cober, cobhar, froth.

Kensey, ceannsa, mild, gentle.

Hayle, sàl, shail, salt water.

Hone, amhainn, rivers.

It is quite evident that into the names which have been now adduced purely Gaelic roots enter—roots which appear very often in the Topography of Ireland and Scotland. The slight examination that I have made of the names of the rivers of Damnonia will tend to exemplify the correctness of the remarks which Lhuyd makes in the Welsh preface to his *Archæologia Britannica :* "There is no name anciently more common on rivers than *Uysk,* which the Romans wrote *Isca* and *Osca,* and yet, as I have elsewhere observed, retained in English in the several names of *Ask, Esk, Usk,* and *Ex, Axe, Ox,* &c. Now, although there be a considerable river of that name in Wales and another in Devon, yet the signification of the word is not understood either in our language or in Cornish ; neither is it less vain to look for it in the British of Wales, Cornwall, or Armoric Britain than it would be to search for *Avon,* which is a name of some of the rivers of England, in English. The signification of the word in *Guydeleg* (*i. e.,* Gaelic) is water. * * * So do the words *uisge, Loch, Ban, Drum,* &c., make it manifest that the *Guydhelod* (*i. e.,* the Gaels) formerly fixed their abode in those places."

Carn, which is eminently a Gaelic word, occurs often in the Topography of Cornwall. *Carn* is one of the most expressive monosyllables that are to be found in the poems of Ossian. As *Cairn* it is commonly used in the English language. *Co nach cuireadh clach 'n a charn,* is a Gaelic proverb of very ancient date.

In Cornwall such words exist as :

Carn brea, briadha, beautiful.

Carn beak, beag, small.

Carn-clog, clach, cloiche, a stone.

Carn Pendower, pen ceann head, *dobhar,* water.

Carn voel, mhaol, maol, bare.

Carn leskez, leus, loisgidh, burning.

Carnglos, glas, grey.

Carn meal, mil, meala, honey.

Carn Tork, torc, a boar.

Carn Enys, Innis, an island.

Cnoc is found in such words as :

Crocadon, cnoc, dun, a hillock.

Crockard, cnoc ard, high.

Carraig, which, along with *carn* and *cnoc* and *dun,* may fairly claim to be regarded as a representative Gaelic word, and which constantly occurs in the Topography of Scotland and Ireland, is present in such names as these :

Carrick gloose, carraig glas, grey.

Carradon, dun, a hillock.

Caregroyne, ron, a seal.

Cardew, dubh, black.

Careg Tol, toll, a hole.

Cardrew, doire, a thicket ; *Druidh,* a *Druid.*

Dun, a hillock or fortress ; Cornish, *Din,* occur in such words as :

Dunbar, barr, a top.

Dunsley, sliabh, a mountain.

Dunster, tir, land.

Dunmear, mear, joyful ; *mor,* large.

Tintagel, Tin, dun, castle ; *diogel* (Cornish), secure. The first syllable is very similar to *dun* or *din.*

Tiadhan is a Gaelic word that signifies a *little hill* ; *dioghailt* in Gaelic signifies revenge. Gaelic roots are thus discernible in *Tintagel,* which is supposed to have been the birth-place and principal residence of the famous Arthur. Borlase says regarding it "that it was a product of the rudest times before the Cornish Britons had learned from the Romans anything of the art of war." So doleful

are the changes which time has effected in the palace of Arthur, that is is no longer like the residence of

"that Arthur who
Shot through the lists at Camlet, and charged
Before the eyes of ladies and of Kings.
The old order changeth, yielding place to new."

It appears that there is an old couplet in Carew's Survey

"By *Tre, Pol* and *Pen*,
You shall know the Cornish men."

The well-known Cornish rhyme is merely an expansion of that couplet:

"And shall Trelawney die?
Here's twenty thousand Cornish boys
Will know the reason why?
And shall they scorn *Tre, Pol* and *Pen*,
And shall Trelawney die?
Here's twenty thousand Cornish men
Will know the reason why."

Camden has the couplet:

"By *Tre, Ros, Pol, Lan, Caer, and Pen*,
You may know the most Cornishmen."

According to him those words mean respectively a *town*, a *heath*, a *pool*, a *church*, a *castle*, or *city*, and a *foreland* or *promontory*.

Tre, trev, a home or dwelling place; Irish *treabh*, Gaelic *treubh*, a tribe or family. The word in question does not enter to any extent at least into the Topography of Scotland and Ireland; though it enters very largely into the Topography of Cornwall, *e. g.*:

Trebean, beagan, a small number.
Tredhu, dubh, black.
Tredryne, droigheann, thorn.
Treglome, lom, bare.
Trekavwr, gobhar, a goat.
Trelase, glas, grey.
Tremeal, mil, meala, honey.

Ros (Cornish, a *heath, mountain*, Gaelic, a *promontory*), occurs in Scotland in such names as *Rosdu, Roseneath, Roslin, Ross, Kinross*; and in Ireland in such names as *Ross, Rosscor, Rossmore*. It enters into such Cornish words as

Roscarnon, carn, a heap or mound.
Roskear, ciar, dusky.

Roskearn, fearna, fhearna, an alder tree.

Roster, tir, land.

Rosevean, bhan, ban, white; *beagan,* a little.

Pol, a pool, mud, occurs in *Poolvash* in the Isle of Man; and such Irish names as *Poolboy, Ballinfoyle, Pollrany*; and in such Scottish names as *Polmont, Polldhu, Poltaxff.*

The presence of *Pol* can readily be observed in such Cornish words as these:

Polbrock, broc, a badger.

Polcairn, carn, a heap.

Poldew, dubh, black.

Poldower, dobhair, water.

Poldrissick, dreasach, thorny.

Polhern, iarunn, iron.

Polkillick, coilleach, a rooster.

Pollick, leac, a flat-stone.

Pollyne, linne, a pool.

Polmellin, muileann, a mill.

Lan. In his Cornish Dictionary, Williams remarks regarding *Lan* "that its primary meaning was a piece of ground enclosed for any purpose—an area to deposit anything in—a house, a yard, a churchyard." In dealing with the Topography of Wales in a previous paper, I endeavoured to prove on the authority of Dr. Joyce, that *lan* or *lann* is a Gaelic word, and that it does not belong exclusively to the Cymry. Lan is often met in the topographical names of Cornwall, *e. g.*:

Lanarth, ard, high.

Lanaton, dun, a hillock.

Lancarf, garbh, rough.

Landare, darach, oak; or *doire,* a thicket.

Landenner, dun, a hillock; *hir sior,* long.

Landew, dubh, black.

Caer, Gaelic *Cathair,* a city or fortified place, which is of frequent occurrence in the Topography of Ireland and Scotland, and to which a very remote origin must be assigned, appears in such Cornish names as:—

Caer Laddon, leathan, broad.

Carbean, ban, white; or *beagan,* a little.

Carcarick, carraig, a rock.

Cardew, dubh, black.

Carhallack, shalach, salach, filthy.

Carhart, ard, high.

Pen, ceann, a head, than which no root is more largely present in the Topography of Ireland and Scotland, enters into very many Cornish names, *e. g.* :—

Pelynt, linne, a pool.

Penavarra, bharr, barr, top ; or *muir, mara,* the sea.

Pencair, caer, cathair, a city.

Pencarra, carraig, a rock.

Pendennis, dinas (C.), *dun.*

Pendew, dubh, black.

Pendour, dobhar, water.

Pendrathen, traigh, a shore.

Pendrean, droighionn, thorn.

Pendalow, da, two, *loch.*

Penellick, seileach, willow.

Peninnis, innis, an island.

Pennard, ard, high.

Penrose, ròs, a headland.

Penryn, rhyn, roinn, a point.

Pentire, tir, land ; the *Kintyre* of Argyllshire.

Pentell, toll, a hole.

It is evident that those distinctive roots or words by which, according to Camden, Cornishmen are to be recognized, are, with the exception of *Tre,* of frequent occurrence in the Topography of Ireland and Scotland, and cannot on that account be restricted to the Cymry, but must be regarded as Gaelic in themselves, and therefore as entering into the Topography of these countries and islands where the Gaels had permanent homes. The citations which have been made from the Topography of Cornwall, in connection with the words or roots in question, show that purely Gaelic nouns and adjectives combine with those roots to form Cornish names.

The Gaelic word *tigh,* a house, enters in the form *chy* into the Topography of Cornwall, *e. g.* :—

Chytane, tigh an teine, the house of fire.

Chelean, tigh an leana, the house of the meadow.

Chenton, tigh an duin, the house of the hillock.

Chycarne, tigh a' chuirn, the house of the cairn.

Chryose, tigh an rois, the house of the foreland.

Coille, the Gaelic term for *wood,* which enters into such Scottish names as *Killiecrankie, Killiemore,* is discernible in such Cornish words as :—

Killiard, coille ard, high.

Killignock, coille cnoc, a hill.

Killigrew, coille garbh, rough.

Killivor, coille, mhor, mor, large.

Lios, a garden or entrenchment, which forms the first syllable of *Lismore* in Scotland and *Lisdoo, Lismoyle, Lismullin,* in Ireland, appear in the Cornish names :

Liskeard, lios gu h-ard.

Lizard, the Cornish Chersonesus, *lios, ard,* high.

Toll, a hole, belongs to the category of expressive Gaelic monosyllables, and is found in such Cornish words as :

Tolcairn, toll cairn.

Toldower, dobhar, water.

Tolver, mor, large.

Tolverne, bhuirn, burn, water.

Porth, port, a harbour, is a Gaelic word of indisputable antiquity, and is present in numerous Cornish names, *e. g.:*

Porth ennis, innis, an island.

Porth glas, glas, grey.

Porth lea, liath, hoary.

Porth loe, loch, a loch.

Portugal, port nan Gaidheal, the harbour of the Gaels, continues to declare that the Gaels could not have been strangers in the far-off ages in the south-west of Europe.

Port na curaich, in the island of Iona, enables the traveller to determine the exact locality where St. Columba first landed from the coracle or wicker-boat covered with hides, that conveyed him from Ireland.

The citations which have been adduced from the Topography of Cornwall furnish satisfactory evidence, that the substratum of that Topography is Gaelic ; and that the conclusion may in all fairness be drawn that Celts, whose language was Gaelic, had their home in that portion of England before the Cymry had a distinctive existence in Britain, and long before the days of Arthur and the Knights of the Round Table.

In his Lectures on *The Science of Language* (1st Series, Lecture II.), Max Müller remarks "that it is not in the power of man either to produce or prevent a continuous change in language. * * * Language cannot be changed or moulded by the taste, the fancy or the genius of man. * * * Language exists in man, and it lives in being spoken. * * * A language as long as it is spoken by anybody lives and has its substantive existence." Cornish is no longer spoken. In 1860 Prince Louis Lucien Bonaparte, in company with the Vicar of the Parish of St. Paul, Cornwall, erected a monument to the memory of Dorothy Pentreath, who died in 1778, and who is said to have been the last person that could converse in Cornish. In the preface to his Glossary of Cornish names, Dr. Bannister remarks, on the authority of Polwhele, that Williard Bodenner, who died about the year 1794 at a very advanced age, could "converse with old Dolly," and "talked with her for hours together in Cornish." Whether Dolly Pentreath was the last person who spoke Cornish or not, it is admitted that about the close of the last century, Cornish ceased to be a spoken language.

It is beside the purpose of this paper to examine the question, as to what place or places may have been included under the designation, *Cassiterides*. The author of an article on Cornwall in the *Encyclopædia Britannica* affirms "that there can be no doubt that Cornwall and Devonshire are referred to under the general name of the *Cassiterides* or the Tin Islands." In adverting to the *Scilly Isles* in his Celtic Britain (p. 44–47), Rhys states that "they have been sometimes erroneously identified with the Cassiterides of ancient authors. * * * There is not a scrap of evidence, linguistic or other, of the presence of Phœnicians in Britain at any time." Warner, in his *Tour Through Cornwall*, which was published in 1809, contends (p. 199) "that it is a fact irrefragably established that the Phœnician colonists of Gades trafficked to the south-western coast of Cornwall from high antiquity." Betham, in his *Gael and Cymbri* (p. 64), asserts "that the Phœnicians were called so, because they were a nation of sailors or mariners, as the word *Phenice* intimates—*feine*, a ploughman, and *oice*, water—a *plougher of the sea.*" A wide divergence of opinion thus prevails as to the relation of the Phœnicians to the south-west of England in the far-off centuries. Betham contends that the word *Scillies* or *Sceleys* is derived from *scal*, noisy, and *uag*, rocks; and that, accordingly, the signification is

sacred sea cliffs. He further states that "*Scylla* or *Scylleum*, the names of promontories in Greece and Italy, and the British and Irish seas; the *Scilliés* off Cape Belerium in Cornwall, and the *Sceligs* off Cape Bolus in Kerry, stand in the same track of Phœnician navigation with Cape Belerium near Corunna in Spain." *Scylla* is derived by Greek writers from *σχύλλω*, to *skin*, to *mangle*. *Scilly* in Cornish means to *cut off*. Hence it has been held that the Scilly Isles received that appellation because they "are cut off from the insular Continent." Joyce, in his *Irish Names of Places* (vol. 1, p. 420), states that *Sceilig* (skellig), according to O'Reilly, means a rock. The form *Scillic* occurs in Cormac's Glossary in the sense of splinter of stone, and O'Donovan, in the Four Masters, translates *Sceillic* sea-rock." I am disposed to believe that the Gaelic word *sgaoil*, to spread or scatter, enters into *Scilly*, and that the Scilly Isles were so designated in consequence of their scattered appearance. It is true that Scilly is likewise regarded as equivalent to *Sulley*, and that thus construed the term means *flat rocks of the sun* (lehau sul).

Gaelic roots appear in the Topography of the Scilly Isles, e. g. :—

Bryher, *bre braigh*, brae ; *hir shior*, long.

Tean, *tiadhan*, a little hill.

Pool, *poll*, a *hole*, mud.

Carn Morval, CARN, a *heap* ; *mor*, large ; *baile*, town.

Peninnis Head, *ceann*, head ; *innis*, island.

Carraigstarne, *carraig*, a rock ; *stairn*, noise.

Carnlea, *carn*, heap ; *liath*, hoary.

Tolmen Point, *toll*, a hole.

Porth Minick, *port*, a harbour ; *manach*, monk.

Port Hellick (the bay in which the body of Sir Cloudesley Shovel was washed ashore) is derived from *port*, a harbour, and *sheilich*, *seileach*, a willow tree.

Drumrock, *druim*, a ridge.

Sufficient evidence has, I trust, been adduced to prove, that the Topography of Damnonia is fundamentally Gaelic ; and that before the arrival or the distinctive existence of the Cymry, Celts who spoke Gaelic inhabited the south-west of England in such numbers and for such a length of time, as to give to the streams and hills and headlands those names which have come down to our own day, and which still reveal their own Gaelic lineage.

Many attempts have been made to explain the Etymology of the word *Britain*. Betham is of the opinion that the Phœnicians gave the name *Briteen* (*brith*, painted, and *daoine*, men) to the people whom they found in Britain; and that the word *Britain* is compounded of *brit*, painted, and *tana*, country, the meaning thus being *the country of the painted people*. It has also been maintained that *Britain* derives its name from *Prydain*, the first legendary King of Britain, after whom the island was called *Ynys Prydain, The Island of Prydain*. Before the Christian era *Albin*, or *Albion*, was an appellation by which the countries now known as England and Scotland were designated. *Albin*, or *Albion*, is now restricted to Scotland, and is the term which the Scottish Gaels apply to that country. *Albin* is in all likelihood compounded of *alb*, *alp*, a mountain, and of *fhonn*, *fonn*, a country, the import of the word thus being *the country of hills or mountains*. The conjecture has been advanced that the name *Britain* is composed of *braigh*, a top, and *tonn*, a wave, *braitoin;* and that that appellation was given to Britain in consequence of its lofty coast line as seen from the opposite shores of Gaul. *Breac*, variegated, and *innis*, an island, *Breacinnis*, is another derivation which has been assigned for the word in question. It is almost needless to remark, that although such interpretations may be ingenious, very much that is fanciful enters into them. An interpretation of a more plausible and accurate kind has recently been given by Prof. Rhys, who maintains that "the Greeks of Marseilles obtained the word *Britanni* from the natives of the south-west of England, who brought their tin to market, and in whose country the only Celtic speech in use was as yet Goidelic." He discovers in the word *Britain*, *Bretnais*, *brat*, *brattan*, the Gaelic term for a covering or a *cloak*,—an argument in support of the theory, that the Celts assumed the name which the Romans afterward wrote *Britanni*, to distinguish themselves as a *clothed* or *cloth-clad* people (*breid*, a piece of cloth) from the naked races who preceded them in the occupation of the British Isles. Though, amid so many explanations of the origin and Etymology of the word *Britain*, it appears to be impossible to arrive at a solution that can be regarded as in all respects satisfactory, it may at least be conceded that the term in question is rather Cymric than Gaelic. *Breathnach* is the name which is applied in Irish Gaelic to a Welshman. *Dumbarton*, which was once the capital of a Kingdom of Britons in the valley of the Clyde, is com-

pounded of *Dun*, a fort or hillock, and *Breatunn, i.e., the fort of Britain*, and, as we may fairly argue, *of the Britons*—if those to whose capital the Scottish Gaels gave the name *Dun-Breatuinn*—, the name by which Dumbarton is known to the Scottish Gaels of our own day. Such words as *Frangach*, a Frenchman; *Sasunnach*, an Englishman, a Saxon; and *Breatunnach*, a Briton, are merely adaptations to the Gaelic language of *France, Saxon, Briton*. The Scot tish Gael is wont to characterize the inhabitants of Scotland as *Albannaich*. *Is Albannach mise*, I am a Scotchman. The word in Scottish Gaelic for a *British subject* or for *the British* is *Breatunnach, na Breatunnaich*. The name *Galbraith* is in Gaelic *Mac a' Bhreatunnaich, the son of the Briton*, and, as we may infer, the son of one who belonged to a different people from the Gaels among whom he may have resided, and whose name is perpetuated in the common surname *Galbraith*.

Whether the exact Etymology of *Britain* can ever be ascertained or not, or whether it may have more than one derivation, the usages of the Gaelic language go to show that it is *Cymric* and not Gaelic; and that, although it passes as current coin in the words *Breatunn* and *Breatunnach*, such words found their way into Gaelic from another source; and even when they are commonly employed, they carry with them reminiscences of an origin that is not purely Gaelic, but is to be construed as indicating that the Gaels of a far-off time adopted such words to describe the members of a race with whom they came frequently in contact, and who, as at Dumbarton, had their home for a time in the immediate neighbourhood, if not in the midst, of the Scottish Gaels.

Dr. Scadding, and Messrs. Buchan and Rouse made remarks on the subject of the paper.

SEVENTH ORDINARY MEETING.

The Seventh Ordinary Meeting of the Session 1884-'85, was held on Saturday, December 13th, 1884, the President in the Chair.

Donations and Exchanges received since last meeting:

1. Appleton's Literary Bulletin, Nos. 11 and 12, Vol. III.

2. Annual Report of the Curator of the Museum of Comparative Zoölogy at Harvard College for 1883–'84.
3. Science, Vol. IV., No. 96, for December 5th, 1884.
4. Transactions of the Manchester Geological Society, Vol. XVIII., Part II., Session 1884–'85.

The minutes of last meeting were read and confirmed.

Mr. J. F. Brown, B.A., and Mr. Martin Luther Rouse were elected members of the Institute.

Mr. Martin L. Rouse read a paper "On the Number, Nature and Musical Character of Vowel Sounds."

Premising that no complete classification of the simple vowel sounds in existence had ever been made, he drew especial notice to the omissions and the anomalies of Walker, Webster, Pitman and Nuttall. Then, by drawing analogies between the pronunciation of English words and comparisons between their utterance and that of French, German and Italian ones, he constructed a table of sixteen true vowels, eight long and eight correlatively short (indicating by examples which of them occurred in the four chief tongues of western Europe)—the vowels heard in the English and French words, *boom* (long), *bush* (short); *mote, morality* (or *maux, mot*); *dawn, don; path* (or *pâte*), *patte; bur, but; age, edge; su, suspendre; keen, kin.* He further resolved six diphthongs used in the four languages into components enumerated in his table; and, departing from all previous traditions, he gave a place among the diphthongs to the *a* of *care* or *ai* of *air*, while he found this diphthong to be unique in possessing a short correlative—the *a* of *carry* or *at.* Being now enabled to test the comparative richness of the languages in vowel sounds, whether simple or compound, he did so not only by counting up the examples in the table itself but by marking from the table every first occurrence of a sound in choice passages of English, French and German poetry (Italian being completely shut out of the competition by the table). The result was greatly in favour of the German; but that language, on the other hand, was shown to be disfigured by oft-recurring gutturals, as was not the case with English, the least monotonous of the remaining three.

The speaker then announced that he had completed a discovery of which only isolated fragments had hitherto been made—of music in the vowels—the eight long simple sounds that he had discriminated making up two perfect musical scales: the one when whispered, the

other when spoken. In each the music ascended from the *oo* in *boom*, regularly through the list to the *ee* in *keen;* and in each the *oo* sound fell upon the same note, which in the speaker's voice was *e* below the bass stave on a high-pitched piano. But the vowels of the whispered scale mounted in the intervals *e*, *a*, *b*, *c* sharp twice repeated, and the latter half of them at least emitted also a fainter resonance descending in the opposite order; whereas the spoken scale was throughout single and chromatic.

Lastly, Mr. Rouse adverted to the use of vowel interjections in common by nations widely severed in habitation and kinship—a permitted relic, as he thought, of the time before the confusion of tongues; and he showed the remarkable fact that each one of the long simple sounds he had distinguished was used in English to express a different emotion—*oo* or *oogh* for anger, *oh* for surprise, *aw* for wonder, *ah* for sorrow, *urgh* for disgust, *eh* for inquiry, *üch* for contempt, and *eegh* for pain.

Remarks were made by Dr. Workman, and Messrs. VanderSmissen, Boyle, Keys, Mowat, Galbraith and Macdougall.

After the reading of Mr. Rouse's paper, Mr. John Phillips introduced the subject of the "Centrifugal Forces of the Planets."

EIGHTH ORDINARY MEETING.

The Eighth Ordinary Meeting of the Session 1884-'85, was held on Saturday, December 20th, 1884, the President in the Chair.

The minutes of last meeting were read and confirmed.

Donations and Exchanges received since last meeting:

1. Monthly Weather Review, November, 1884.
2. Journal and Proceedings of the Hamilton Association for 1882-'83, Vol. I., Part I.
3. Canadian Entomologist, Vol. XVI., No. 10, October, 1884.
4. Science, Vol. IV., No. 97, December 12th, 1884.
5. Second Annual Report of the Bureau of Ethnology, Smithsonian Institution, 1880-'81.
6. Boletin de la Academia Nacional de Ciencias in Cordoba (Republica Argentina), Tomo VI., Entregas 2*a* & 3*a*.

Mr. Aubrey White was elected a member of the Institute.

Mr. Sandford Fleming, C.M.G., read the following paper on

UNIVERSAL OR COSMIC TIME.

On the first day of the month, the President of the United States, in his message at the opening of Congress, referred to the International Meridian Conference lately convened in Washington, in the following words :—" The conference concluded its labours on the first of November, having with substantial unanimity agreed upon the meridian of Greenwich as the starting point whence longitude is to be computed through one hundred and eighty degrees eastward and westward, and upon the adoption for all purposes for which it may be found convenient of a universal day, which shall begin at midnight on the initial meridian, and whose hours shall be counted from zero up to twenty-four."

The Canadian Institute is peculiarly interested in this announcement. No society, literary or scientific, has taken a more important part in the initiation of the movement to reform our Time System, of which the success is, to some extent, indicated in the President's words. It therefore appears to me fit and proper that I should recall to your attention the various steps which, from time to time have been taken so that we may possess a record of the events which have led to the now almost general recognition of the necessity for a new notation.

Six years ago on several occasions the meetings of the Institute were engaged in discussing the subject of Time-reckoning and the selection of a Prime Meridian common to all nations. Papers were read and arguments were advanced, with the view of showing the necessity of establishing a cosmopolitan or universal time, by which the events of history might be more accurately recorded, and which would respond to the more precise demands of science, and generally satisfy the requirements of modern civilization. The proceedings of the Institute for January and February, 1879, give at considerable length the views submitted and the suggestions offered to meet the new conditions of life. While on one hand it was argued that the introduction of a comprehensive scheme by which time could be universally reckoned was highly desirable, it was equally maintained

that the determination of a common Prime Meridian for the world was the key to its success, and that the establishment of such a meridian, as a zero, recognized by all nations, was the first important step demanded.

These proceedings were brought under the notice of His Excellency the Marquis of Lorne, then Governor-General of Canada. In the name of the Institute, they were submitted, in the form of a memorial, with the hope that His Excellency would see fit to lay them before the Imperial Government. That they would by these means obtain the attention of the several scientific bodies throughout Europe, and that some general systematic effort would be made in the right direction to secure the important objects sought to be attained.

Through the good offices of His Excellency, copies of the Canadian Institute proceedings found their way to the British Admiralty, the Astronomer Royal, Greenwich, The Astronomer Royal for Scotland, Edinburg, The Royal Society, The Royal Geographical Society, The Royal Astromomical Society, The Royal United Service Institute, and other societies of eminence and weight in the United Kingdom. Copies of the papers were likewise sent through the Imperial Government to the governments of the following countries, viz. :

FRANCE,	GERMANY,
ITALY,	NORWAY AND SWEDEN,
THE UNITED STATES,	RUSSIA,
AUSTRIA,	BELGIUM,
BRAZIL,	DENMARK,
JAPAN,	THE NETHERLANDS,
SPAIN,	PORTUGAL,
SWITZERLAND,	TURKEY,
GREECE,	CHINA.

In the year following, the American Metrological Society issued a Report of the Committee on Standard Time. It bears the name of Mr. Cleveland Abbe, the Chairman of the Committee, and the date of May, 1879. It draws attention to many of the causes calling for the establishment of accurate time, and the attempts made since the establishment of the electro-magnetic telegraph to make the notation of time synchronous. While pointing out that this result had been obtained in Great Britain through the efforts of Professor Airy, Mr. Cleveland Abbe gave a list of the

various observatories on this continent which are in possession of the necessary apparatus and force proper to furnish astronomically accurate time by telegraph. Writing in February, 1880, while giving the resolution adopted by the society, recommending the adoption of accurate time by telegraph from an established astronomical observatory, Mr. Cleveland Abbe points out that the subject of accurate time had been taken up by the Horological Bureau of the Winchester Observatory of Yale College, and that the most perfect apparatus had been received for the purpose of distributing New York time to the highest degree of uniformity and accuracy.

Mr. Cleveland Abbe's own remarks on the subject are of high value. He forcibly points out the difficulties and inconvencies under which railway operations in America labour from the want of a proper system of time. To show this fact in greater force, he gives the seventy-four standards then followed. These several standards he proposed to set aside and replace by standards each differing one hour or 15° of longitude.

While recommending this course, the report sets forth that the change could only be regarded as a step towards the absolute uniformity of all time-pieces, and the Society passed resolutions, that absolute uniformity of time is desirable; that the meridian six hours west of Greenwich should be adopted as the national standard to be used in common on all railways and telegraphs, to be known as "Railroad and Telegraph Time;" that after July 4th, 1880, such uniform standard time should be the legal standard for the whole country, and that the State and National Legislatures should be memorialized on the subject.

Mr. Cleveland Abbe in this report alluded to the previous proceedings of the Canadian Institute.

The active sympathy of the Marquis of Lorne greatly aided the movement of Time-reform in its early stages. In 1879, in his official position as Governor-General he had been the recipient of the papers published by the Canadian Institute, and had transmitted them to Great Britain, and through the Imperial Government to the several European centres. In 1880, it was learned that the report to the American Metrological Society above alluded to, would shortly be issued. Accordingly, advance copies were obtained from New York, and, together with additional papers issued by this Institute, they were transmitted by His Excellency to the following

European Societies, and the special attention of their members was directed to the documents themselves :

1.	The Institut de France	Paris.
2.	Societè de Geographie	Paris.
3.	Societè Belge de Geographie	Brussels.
4.	Königlich Preussische Akademie der Wissenschaften	Berlin.
5.	Gesellschaft für Erdkunde	Berlin.
6.	Kaiserliche Akademie der Wissenschaften	Vienna.
7.	K. K. Geographische Gesellschaft	Vienna.
8.	Nicolaevskaia Glavnaia Observatoria	Pulkova.
9.	Imper. Rousskae Geograficheskoe Obschestov	St. Petersburg.
10.	Imp. Akademia Nauk	St. Petersburg.
11.	Societè de Geographie	Geneva.

By this means attention was obtained for the subject in Europe, and when I submit evidence of the fact, I think you will agree with me, that no little of the success which has attended the movement is owing to our late Governor-General. We must all acknowledge how much we are indebted to him for the great personal interest he has always shown on the subject. We are certainly warranted in forming the opinion, that the dissemination of these papers, under such distinguished auspices, awakened attention to the arguments they contain, and prepared the way for the subsequent action taken at the International Geographical Congress at Venice, at the Geodedic Congress at Rome, and more recently at the Conference at Washington.

Mr. Wilhelm Förster, director of the Berlin Observatory, enters into the subject at length in a paper "Zur Beurtheilung Einiger Zeitfragen, insbefondene gegen die Einfuhrung einer deutschen Normalzeit." [A Review of some considerations on Time, especially against the introduction of German National Uniform Time].

Mr. Förster proceeds to say : The British Government is now transmitting, through its representatives, although at the same time it declares itself neutral, a proposition which has been published by a society of scientific men in Canada, which aims at the establishment of a cosmopolitan normal datum (Prime Meridian) and of Universal Time, and also the establishment of 24 meridians of an hour apart, by which local time will be absorbed. The first proposal, Mr. Förster describes as an important sign of the times and evidently favours it.

He strongly protests against the establishment of a national German time; but for railway business, and for such matters of commu-

nication which require precision, also for the form of expression of all scientific relations to time, Mr. Förster points out that a universal time common to the whole world is to be recommended.

Dr. G. Von Boguslauski, in the *Verhandlungen der Gesellschaft für Erdkunde*, (transactions of the Geographical Society of Berlin), commends the new scheme as it has been put forth in the Canadian Institute papers, and foretells that it will be a matter of fact in a short time.

Col. Aden, Director of the Military School, Belgium, has two papers in the *Bulletin de la Societé Belge de Geographie.* He supports the proposal to establish universal time, and expresses the opinion that longitude throughout the world should have a common notation, dating from one universally accepted Prime Meridian.

Col. Wauverman, President of the Geographical Society of Antwerp, in the Bulletin of that society, 1882, advocates the change, and with ability meets the arguments raised against it, showing them to be groundless and arising from a want of thoroughly understanding the question.

In Spain, the proposals have met with full support. All the papers issued by the Canadian Institute have been translated and published in a pamphlet of 80 pages by the Revista General de Marina. The translator, Don Juan Pastorin, an officer of the Spanish navy. is warm in his commendation of the scheme, and takes a wise and comprehensive view of the whole question. The Spanish Government secured the advantage of this gentleman's services as a delegate to the Washington Conference.

M. Otto Struve, the well-known Astronomer and Director of the Imperial Observatory, Pulkova, reports on the papers transmitted by Lord Lorne to the Imperial Academy of Sciences, St. Petersburg. He gives his adherence to the establishment of Universal Time, based, as suggested, on a Prime Meridian common to the whole globe, and strongly advocates counting the hours in one series up to twenty-four.

In England, the Royal Society considered favourably both the establishment of a Universal Time and the determination of a common Prime Meridian, while the psesent Astronomer Royal, Mr. Christie, takes a favourable view of the question, his predecessor, Sir G. B. Airy, reported in a qualified manner. The report of the Astronomer Royal for Scotland, Prof. Piazzi Smith, is unfavourable. The latter documents have already been submitted to the Institute.

In Italy, the Italian Geographical Society has given its countenance to a work by Mr. Fernando Bosari, who, in a pamphlet of 68 pages, reviews the whole question at length, and lays down three principles; 1. The determination of a zero meridian; 2. The establishment of cosmopolitan time based upon it; 3. The notation of the hours from 1 to 24 in a continuous series.

The question of Universal Time and the selection of a Prime Meridian is discussed with ability in a paper published by M. Thury, professor at the University of Geneva.

At the meeting of the Association for the Reform and Codification of the Laws of Nations at Cologne, Prussia, in 1881, the question of regulating time on the new system was considered and resolutions moved.

In the same year (1881), the subject occupied the attention of the International Geographical Congress at Venice, at which a delegate from the Canadian Institute attended. The general question was warmly discussed, and resolutions adopted. The appointment of an international conference to meet at Washington, specially to consider the question, was then suggested by the Canadian delegate. The president of the Congress communicated the resolutions to the Italian Government, and Prince Teano, on behalf of the Italian Government, undertook to conduct the official correspondence. Out of this appears to have sprung the important discussion at the meeting of the International Geodetic Association at Rome, in October, 1883, when the utility of Universal Time was recognized, and a special international conference for the establishment of a zero meridian for longitude and time recommended.

Turning to this side of the Atlantic, the question of regulating time for railway, telegraph, and civil purposes generally, was considered at the Convention of the American Society of Civil Engineers, held at Montreal, June 15, 1881, and a committee of men engaged in the management and familiar with the economy of railways, appointed to examine the question. The committee has reported from time to time. They recognized that a proposition to reform the general time system of the country was a problem beset with difficulties, but it did not appear to them insolvable. It was felt, however, that the question affected so many interests that any change could only be effected by general concurrence.

To attain the end propoesd by this society, the papers bearing on the question were printed, and a scheme modified on the proceedings of the Canadian Institute was drawn up, under the title of "Cosmopolitan scheme for regulating time."

I may briefly recall the features of the scheme.

There should be one standard of absolute time, a Universal Day, based on the mean solar passage, at one particular meridian, the Prime or initial meridian for computing longitude. This Prime Meridian, together with the universal day, to be observed by all civilized nations.

There should be 24 secondary or hour meridians established, 15 degrees of longitude apart, beginning with the Prime Meridian as zero.

To distinguish the universal day from local time, it should bear the title of "Cosmic Day."

[NOTE.—I may remark, that the designation "Cosmic" was first suggested, independently, by two Canadian gentlemen widely separated, by Mr. R. G. Halliburton, then in Algiers, and by Mr. Thomas Hector, of Ottawa. The etymology commends the use of the word. It has been accepted by a number of societies and by many individuals as appropriate and applicable.]

Cosmic time is intended to be used to promote exactness in chronology, and to be employed in astronomy, navigation, metrology and in synchronous observations throughout the world. To be employed in ocean telegraphy and generally in all operations non-local in character.

The several twenty-four meridian to be used as standards local time around the globe. Applying the system to North America, the effect would be to reduce tbe standards to four or five, as suggested by the metrological society.

A circular, dated March 15th, 1882, signed by Mr. John Bogart, the Secretary of the American Society of Civil Engineers, was forwarded to the leading men in railway direction, either as general managers, superintendents or engineers, and to men of scientific attainments throughout the United States and Canada. The papers thus circulated contained eleven questions, and catagorical replies were invited to them.

Replies were received and reported on at a convention of the society, held in Washington on the 17th May, 1882. The scheme submitted was generally and cordially approved.

An emphatic and unanimous opinion was expressed, that there should be established as early as possible a comprehensive system of Standard Time for North America.

Of those who replied to the queries, ninety-five per cent. favoured the idea that there should be a common agreement between the standards of time in all countries. That while we must primarily look to our own convenience on this continent, it is proper to aim at eventually attaining general uniformity among all nations.

Seventy-six per cent. were in favour of reducing the standards in North America so that they would differ only by intervals of one hour, and ninety-two per cent. were in favour of a notation of the hours of the day in a single series from 1 to 24, instead of in two divisions each of twelve hours.

The character of the replies received indicated that a remarkable unanimity of opinion prevailed in every section of the continent heard from. The Convention accordingly resolved that an attempt should be made to obtain European concurrence to the selection of a Prime Meridian on which a time system could be definitely based. But, failing to obtain this recognition, the people of the Western Continent should determine a zero meridian for their own use and guidance.

It was thereupon resolved to petition the Congress of the United States to take the matter into consideration. The American Metrological Society about the same time adopted a similar proceeding. The consequences were that a Joint-Resolution of the House of Representatives and the Senate was passed authorizing the President of the United States to call an International Conference to fix on and recommend for universal adoption a common Prime Meridian to be used in the reckoning of longitude and in the regulation of time throughout the world.

On the meeting of the American Association for the Advancement of Science in Montreal, in July, 1882, the subject was brought forward, and all the documents were submitted and discussed. It was agreed that the Association should co-operate with other bodies in furtherance of the movement.

On two occasions the Royal Society of Canada has had its attention directed to the matter, and this body has assisted in furthering the determination of the problem by its co-operation and by correspondence with the Government.

Some delay took place in summoning the International Conference by the President, in consequence of lengthy correspondence on the subject between the United States Government and the Governments of other countries. In the meantime a decision with respect to the regulation of local time had been anticipated by the railway authorities in North America, who adopted the system of hour standards which had been prominently brought forward as described.

On November 18th of last year (1883) the new system of regulating railway time on this continent came into operation. There had been several preliminary meetings of railway managers; the last meeting was a Convention held in Chicago the previous October, and it was then determined immediately to carry out the change.

Mr. W. F. Allen, the secretary of this Convention, who also took a prominent part in effecting the adoption of the change, has given a history of the events leading to it. Upon this gentleman mainly fell the labour of arranging details, and he executed the difficult duties assigned to him with consummate ability. In the words of the historian, the transition from the old to the new system "was put into effect without any appreciable jar, and without a single accident occurring." According to this authority the first newspaper to advocate some change was the *Railroad Gazette* for April 2, 1870, and it is claimed that as early as 1869 Prof. Charles F. Dowd, Principal of Temple Grove Ladies' Seminary, Saratoga Springs, proposed a system of meridians based on the meridian of Washington at intervals of one hour, by which railways should be operated, and that an expression of his views was placed in the hands of the President of the New York and Canada Railroad. The proposition appears to have attracted attention in the *Travellers' Official Guide* of 1872. In 1873 it was brought before the Railway Association of America, not now in existence. A committee was appointed to examine into its merits; they failed to recognize its necessity, and recommended that the question of national standard time for use on railways be deferred until it more clearly appeared that the public interests called for it.

Mr. Dowd's efforts to introduce a national standard time to meet the difficulties which were being developed were at the time imperfectly appreciated. He, however, has had the satisfaction of seeing a scheme unanimously accepted, and put in operation, which in essential features does not materially differ from that which he ad-

vocated; and he himself attended at the meeting of the American Metrological Society, and took part in the proceedings when the details of the new time arrangements were officially narrated.

Prominent among those who have earnestly laboured to advance the movement of time-reform is the distinguished president of Columbia College, New York. Dr. Barnard has from the first taken the deepest interest in the question, and few men have done so much to bring it to a practical issue. In the proceedings of the American Metrological Society for 1881 will be found a paper prepared by Dr. Barnard in 1872, and presented to an association which has since assumed an international character, and known as the association for the Reform and Codification of the Laws of Nations. In this paper Dr. Barnard recommends the selection of Greenwich as the Prime Meridian for the world, and he submits the views he held at that early date, which at this hour are of peculiar interest. He points out that "it is becoming a matter of greater importance every day that there should be established some universal rule for defining the calendar day for all the world."

I have alluded to the valuable report of Professor Cleveland Abbe, of the United States Signal Service, to the Metrological Society, and I cannot deny myself the pleasure of acknowledging the services of the gentlemen with whom I have been associated on the special committee on Standard Time of the American Society of Civil Engineers, Mr. Paine, of New York; Mr. Theodore N. Ely, of Altoona, Pennsylvania; Mr. J. M. Toucey, of the Hudson River Railway; Professor Hilgard, Coast Survey, Washington; Professor Egleston, of Columbia College; General T. G. Ellis, of Hartford, now unfortunately deceased, and Mr. John Bogart, Secretary of the Society,

The American Society of Civil Engineers, since meeting in Montreal, in 1881, has made persistent and continuous efforts in the common interest to advance the movement of Time-reform, having greatly aided in bringing about the important change carried into effect a year ago. This society is now directing attention to a reform of scarcely less importance, the notation of the hours of the day. At the Buffalo convention in June last, this particular question received prominent consideration in the address of the President, as well as in the report of the special committee. Since that date a correspondence has taken place between the Secretary and the Railway Managers in the United States and Canada. Already replies have been received

from the representatives of some sixty thousand miles of railway, ninety-eight (98) per cent. of whom have given expression to their sympathy with the movement, to abandon the old practice of halving the day, designating the two sets of twelve hours by the abbreviations A.M. and P.M., and are prepared to adopt a simple notation of 1 to 24 in a single series, The great telegraph interests of the country are likewise in full sympathy with it. The President of the Western Union Telegraph Company, Dr. Norwin Green, states that their telegraphic traffic is equal to the transmission of forty-four million messages a year, and the general adoption of the 24 o'clock system, as it has been designated, would be cordially welcomed by telegraphers. It would reduce materially the risk of errors, and to the company over which he presides, he says it would save the transmission of at least 150,000,000 letters annually.

The branch literature bearing on the two questions of Universal Time and the establishment of a Prime Meridian, has been enriched by a series of papers which have appeared during the past year in the *International Standard*, a magazine published in Cleveland, Ohio. These papers are by the following gentlemen connected with the International Institute :—Rev. H. G. Wood, of Sharon, Pennsylvania ; Professor C. Piazzi Smyth, Astronomer Royal for Scotland ; Professor John N. Stockwell, Astronomer, Cleveland ; Mr. Jacob M. Clark, C.E., New York ; Mr. William H. Searle, Pennsylvania ; L'Abbé F. Moigno, Canon of St. Denis, Paris ; Commodore Wm. B. Whiting, U. S. Navy ; Mr. Charles Latimer, C.E., Cleveland ; and others.

It will be seen from what I have submitted, that the proceedings have neither been few nor without success. That since this Institute published the first issue of papers on Time and Time-reckoning, the subject has received much attention on both sides of the Atlantic. Societies with kindred pursuits, men of recognized merit in the scientific world, have turned to its examination and aided in its development. Some few men have acted in concert. The labour of others have been independent. Some of these names I have been able to record, but I fear that I neglect to include many of eminence because they are not known to me. It is this varied and widely diffused effort which has rendered possible the realization of the practical results which I have the gratification to record, and all

must equally join in the common satisfaction in the measure of success which has been achieved.

Six years back, when the subject was discussed in this hall, there were probably not a few who viewed the propositions then submitted as merely fanciful theories. Others who did not refuse to recognize their bearing, entertained the feeling that many grave difficulties presented themselves to interfere with any successful attempt to reform or modify usages so ancient as the computation of time. But the Institute, as a body, was hopeful. The action taken by the Council to extend the field of discussion and awaken the attention of foreign communities, evinced confidence, and we may now ask, was this confidence justified? What are the facts to-day? Twelve months have passed since an important change in the notation of Railway Time was made with general approval throughout the length and breadth of North America, a revolution in the usages of sixty millions of people has been silently effected and with scarcely a trace that it has happened. A proceeding which has been followed by events of equal importance. On the 1st of October last a body of accredited delegates from the different nations, on the invitation of the President of the United States, met in conference to consider the problem first submitted to the world by this Institute. The delegates were the representatives of twenty-five (25) civilized nations. The conference continued during the whole month of October, and, as a body, they came to conclusions affecting all peoples living under our theories of civilization.

It was early understood that a determination with respect to Universal Time was not possible without the general recognition of an initial meridian. Hence the importance attached to its choice, that it should be universally accepted.

For many years attempts have been made to effect the establishment of an initial meridian recognized in common by all nations, but every attempt hitherto had proved completely unsuccessful. It is therefore the greater cause for congratulation, that the efforts of the Washington conference have succeeded in its determination.

The discussions of the conference were long, and being carried on in different languages, could not have been of equal interest to all present. Translations became necessary, so that all the delegates might equally understand the propositions which were daily submitted. This necessary course prolonged the sessions and multiplied

the adjournments. At last, however, the choice of a Prime Meridian was obtained. The following resolution was passed, the delegates voting by nations :

" *Resolved*, That the Conference proposes to the Governments here represented the adoption of the meridian passing through the centre of the transit instrument at the Observatory of Greenwich as the initial meridian for longitude.

The above resolution was adopted by the following vote :

In the affirmative :

AUSTRIA,	MEXICO,
CHILI,	NETHERLANDS,
COLOMBIA,	PARAGUAY,
COSTA RICA,	RUSSIA,
GERMANY,	SALVADOR,
GREAT BRITAIN,	SPAIN,
GUATEMALA,	SWEDEN,
HAWAII,	SWITZERLAND,
ITALY,	TURKEY,
JAPAN,	UNITED STATES,
LIBERIA,	VENEZUELA.

In the negative :

SAN DOMINGO.

Abstained from voting :

FRANCE AND BRAZIL.

AYES 22. NOES 1.

There was less difficulty and even greater unanimity displayed when the consideration of Universal Time was submitted. The Conference adopted the principle of a Universal Day without a single negative vote. The resolutions carried are substantially in accord with the essential principles, if not with the precise features of the proposals set forth in the proceedings of the Institute, published in 1879.

The resolution defining the Universal Day reads as follows : " *Resolved*, That this Universal Day is to be a mean solar day ; is to begin for all the world at the moment of mean midnight of the initial meridian, coinciding with the beginning of the civil day and date of that meridian, and is to be counted from zero up to twenty-four hours."

This definition, taken in conjunction with the other resolutions of the Conference, is fraught with important consequences.

When it is mean midnight at Greenwich, that moment it is mean noon at the meridian 180° from Greenwich, as indicated by the solar passage. Hence the anti-Prime Meridian practically becomes the time-zero for the world.

The initial instant of the twenty-four hours of each successive Universal or Cosmic Day is the moment of mean solar passage on the Anti-Prime Meridian. The first hour of the Cosmic Day is at the solar passage on the meridian 15° westward This then becomes the 1st hour meridian. The second hour of the Cosmic Day is at the solar passage on the meridian 15° still further westward. This becomes the 2nd hour meridian. And so on in turn, each meridian which is an exact multiple of 15° from zero becomes an hour meridian corresponding in number with the numbers of the successive hours of the Cosmic Day.

The twenty-four hour meridians so determined come in the following order, viz. :

LONGITUDE EAST AND WEST.	HOUR MERIDIAN.	COSMIC TIME AT SOLAR PASSAGE.
ANTI-PRIME MERIDIAN	ZERO.	THE DAY BEGINS.
165° East	1st Hour Meridian	1 o'clock.
190° East	2nd " "	2 "
135° East	3rd " "	3 "
120° East	4th " "	4 "
105° East	5th " "	5 "
90° East	6th " "	6 "
75° East	7th " "	7 "
60° East	8th " "	8 "
45° East	9th " "	9 "
30° East	10th " "	10 "
15° East	11th " "	11 "
Prime Meridian	12th " "	12 "
15° West	13th " "	13 "
30° West	14th " "	14 "
45° West	15th " "	15 "
60° West	16th " "	16 "
75° West	17th " "	17 "
90° West	18th " "	18 "
105° West	19th " "	19 "
120° West	20th " "	20 "
135° West	21st " "	21 "
150° West	22nd " "	22 "
165° West	23rd " "	23 "
160° West	24th " "	24 "

Thus the exact position of the twenty-four secondary or hour meridians is practically determined, and provision is thereby made for extending around the globe so as to secure complete uniformity, the hour system of regulating time which has been adopted with so much advantage in America.

These hour meridians, so designated, completely establish the relation between Cosmic time and longitude and likewise between Cosmic time and local time. Once every day the relationship will be prominently brought under the notice of every individual. Any one, for example, living on the 6th hour meridian, will know at noon that it is at that instant six o'clock Cosmic time; or, take a citizen of Toronto, the local time of which would be governed by the 17th hour meridian. At the instant of noon he will know that it is 17 o'clock Cosmic Time. Invariable time will thus agree with longitude, conversely longitude with time. The earth itself becomes the great chronometer, and in its daily relations the passage of the sun will everywhere be the index of Cosmic time.

The resolutions of the International Conference establish a means of reckoning time which promises, in the years to come, to be of the highest advantage to the human family. Cosmic time, or whatever name may be given to Universal Time applied to civil purposes is an entirely new feature. It has now obtained recognition by a properly constituted authority, although until recently, I believe, it has remained unconsidered. Astronomers have long had equinoctial time, which is absolute time, dating from an epoch determined by the sun's motion among the stars; beyond this I cannot find any nearer approach to the mention of Universal Time as now understood.

The conclusions of the Conference mark a new era. The civil time of England is adopted as Universal Time. It may be said that Greenwich time is already known on every sea, that it has been carried by British ships wherever British explorers and colonists and merchants have penetrated, but Greenwich time is the local time of Greenwich, and, heretofore, it has always been held as such. Universal time, based on the Prime Meridian of the globe, and recognized by the several civilized nations is an entirely different conception. As the time of the world common to every nation, it is held that the term Cosmic will better express that meaning than Greenwich. Cosmic and Greenwich time are identical, by accident, but the expressions imply two totally different ideas, and known national

sensitiveness suggests the good taste and expediency of distinguishing the two ideas by different terms.

I am induced to add a few words in explanation of the principles of Cosmic time.

Time has been the subject of profound thought by many philosophic minds of the past. They have attempted to define it, and their definitions have been manifold. If we view the earth as a whole, and the conditions of the age in which we live, oblige us so to view it, I am unable to see that any one of the recorded definitions gives support to the ancient system of keeping count of time which we follow. Our ordinary usages imply that there is an infinite number of times, and they are based on the principle that time is dependent on local situation. Nothing can be more erroneous and misleading. It is this false principle entering into every detail of daily life which has led each insignificent locality on the circumference of the globe to claim the right to have its own time. It is self-evident that time is in no way dependent on locality, I will quote on this point but one authority, the great Sir Isaac Newton. "Absolute true and mathematical time of itself, and from its own nature, flows equally without regard to anything external."

Our finite minds are incapable of understanding fully what time is, but this much is perfectly clear to our reason. Time is a measureable quantity, it may be termed a flowing magnitude, and only as one such magnitude is it conceivable. A distinct and separate flow of time in each of the myriad localities throughout the universe is perfectly inconceivable. If time be anything it is a *unity* and not a *plurality*. The cardinal principle of Cosmic time is *unity*, and with unity as a fundamental idea of time it must be held that the Cosmic system is the only sound principle of reckoning, and that as the area of civilization broadens, it must in the end be recognized as applicable everywhere and for all purposes.

The conclusions of the International Conference are fruitful of results of high importance. They may be said to point to the opening of a new chapter in the world's annals. They make provision for a complete cessation of ambiguity in hours and dates. By Cosmic Time all events whatsoever will be systematically arranged according to their proper chronological order. The calendar days the world over consequently will begin at the one initial instant, and clocks will strike the same hour at the same moment in all longitudes.

But the new system can only be gradually introduced. The majority of mankind have firmly fixed ideas with regard to the passage of the day and the numbers of the hours by which their social habits are regulated. A proposal suddenly to change the old familiar succession of the hours will be misunderstood. The influence of custom is always powerful under any aspect. It is anticipated that this influence will be the one serious obstacle to be overcome. The belief, however, may be permitted that the change will be rendered easy when men understand that the numbers of such hours have been arbitrarily chosen; that there is no necessary connection between them and the position of the sun in relation to the earth in its daily rotation, and that whatever numbers may distinguish the twenty-four divisions of the day, the recurring phenomena of light and darkness will always regulate sleeping, waking, eating, and working, and all the routine of life in every locality. Noon has heretofore been associated in our minds with the hour of 12, but among the Jews noon was the 6th hour, and astronomers have almost invariably recognized it as the 24th hour. For a year back throughout the United States and Canada the agreement between 12 o'clock and precise noon has been at an end. It may be said that, except on four or five meridians, 12 o'clock is nowhere coincident with mean solar noon. This departure from an old usage must tend to unloosen the traditional idea that the mere numbers of the hours have any necessary connection with the position of the sun in the heavens. If this innovation has any effect it must help to pave the way for still further and more important changes than have yet been introduced. The meridians by which time is regulated in North America are 5, 6, 7 and 8 hours of longitude west from the Prime Meridian. It will only be necessary to move forward our clocks 5, 6, 7, and 8 hours respectively to bring them all into agreement with the time of the Prime Meridian which is Cosmic Time, and thus obtain complete uniformity. It cannot, however, be looked for that Cosmic Time will at once be adopted in ordinary affairs. A generation probably will pass away before it will obtain general acceptance. The difficulties to be overcome cannot be ignored, and we may assume that it will only be step by step that the change will be made, the more advanced nations taking the lead. On this continent positive progress has been made, to be succeeded before long, I do not doubt, by another advance in public opinion, and a general acceptance of the principles

recently recognized. In the course of years the prejudices engendered by inherited customs will be greatly modified, and the masses will gradually have their minds familiarized with new ideas. It is a significant fact that the principles of the new system should be unanimously recommended by delegates from all civilized nations. I do not doubt that the several peoples they represent will sooner or later understand that one uniform reckoning of time for every purpose throughout the globe is the only rational system, and the one notation which in coming years will properly meet the necessities and requirements of mankind.

In these remarks I have narrated the events which have taken place on both sides of the Atlantic to influence and determine the conclusions which, a few weeks back, the President submitted to the Congress of the United States.

On this occasion I cannot think that I am entirely wrong when I venture to congratulate the Canadian Institute on the part which it has taken in the solution of this problem. It stands among the Societies who first considered this comparatively new question. Indeed, it may be claimed that the Institute is to some extent the pioneer Society in awakening the world to the advantages to be derived from the establishment of Cosmic Time..

In conclusion, I will avail myself of the words of an early President of the of the Institute, whose portrait for more than thirty years has adorned the hall in which we are now assembled. Referring to the results already effected in Time-reform and the prospects for the future, General Sir Henry Lefroy, in his address at the late meeting of the British Association in Montreal, remarked: "Whether we conceive its educational tendency or its influence on future intercourse of unborn millions, it is a somewhat remarkable evidence that agreement upon questions of general concern is not that unattainable thing which we are apt to consider it."

Questions as to the effect of the proposed change were put by Mr. Notman, Mr. Murray and Mr. Macdougall, and answered by Mr. Fleming. Mr. Carpmael referred to the Spanish translation of Mr. Fleming's previous papers. Dr. Meredith congratulated the Institute on its having taken the initial proceedings. The President also made some remarks on the subject.

The following Resolution was moved by Dr. E. A. Meredith, seconded by Mr. W. H. VanderSmissen, and passed :

"That the meeting, considering this as an exceptional case, desire to tender a cordial vote of thanks to Mr. Sandford Fleming, C.M.G., for his interesting communication on the subject of 'Cosmic Time,' and they wish, at the same time, to record their satisfaction that to one of the original members of the Institute is due the honour of being the first to bring prominently before the scientific world, through the medium of the Journal of the Institute, the important subject of Time Reform, and the adoption of uniform or Cosmic Time."

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NOTES.

1.—The First Series has for title, "The Canadian Journal: a Repertory of Industry, Science and Art; and a Record of the Proceedings of the Canadian Institute." The Second Series has for title, "The Canadian Journal of Science, Literature, and History." The title of the Third Series is, "Proceedings of the Canadian Institute." Parts 1 & 2, Third Series, are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

2.—By inadvertence, No. 85 (November, 1873) of the "Canadian Journal," 2nd Series (Vol. XIV.) immediately follows No. 79. There is, however, no *lacuna* between these two numbers, as is shown by the fact that the paging is consecutive.

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UNIVERSAL OR COSMIC TIME,

BY

SANDFORD FLEMING, C. E., C. M. G., ETC.

TOGETHER WITH OTHER COMMUNICATIONS AND REPORTS IN THE POSSESSION OF THE CANADIAN INSTITUTE,

RESPECTING THE MOVEMENT FOR REFORMING THE TIME-SYSTEM OF THE WORLD, AND ESTABLISHING A PRIME MERIDIAN COMMON TO ALL NATIONS.

TORONTO:
COPP, CLARK & CO.
1885.

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The Earth itself becomes the Standard Chronometer for all Nations.
The Solar passage is everywhere the Index of Cosmic Time. (see page 20.)

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INTRODUCTION.

The documents included in this *fasciculus* not being part of the ordinary transactions of the Canadian Institute, their publication by the Institute calls for a word of explanation.

During the winter session of 1878–1879 Mr. Sandford Fleming, one of the earliest members of the Institute, communicated to the Society two remarkable papers—one on "Time-Reckoning," and the other on "The Selection of a Prime Meridian to be Common to all Nations, in Connection with Time-Reckoning."

These communications were of such world-wide interest, the questions discussed were of such practical importance, that the Council of the Institute thought it desirable that they should be brought officially under the notice of as many leading learned societies as possible, both on this continent and in Europe; this seemed all the more desirable inasmuch as the suggestions made by Mr. Fleming could only be carried out by the united action of the civilized nations of the world, and such action could be best secured through the intervention of the national scientific societies.

The Council accordingly addressed a memorial to the then Governor-General, the Marquis of Lorne, requesting him to transmit Mr. Fleming's communications to the Imperial Government and to the representative learned societies of Europe and America. His Excellency kindly acceded to their request, and in forwarding the papers to these scientific societies, he invited them to communicate to him their views upon the proposals discussed in the papers. The replies received have been placed by His Excellency at the disposal of the Institute, and are included in this volume.

In publishing these replies, and the other documents which accompany them, the Institute is influenced by the desire to preserve a full and permanent record of the history of this interesting scientific movement, from its first practical discussion before the Canadian Institute in the winter of 1878, until the virtual

adoption of Mr. Fleming's views by the International Scientific Conference at Washington in 1884.

In a paper read during the last winter before the Canadian Institute and included in this *fasciculus*, Mr. Fleming has given an interesting history of the whole movement, he has pointed out the share which many learned societies in Europe and America have taken in the work. He has honourably mentioned the names of many scientific men who have assisted in the discussion, nor has he forgotten to notice in what way the Institute has helped forward the movement. To his own continued earnest and honourable labours in the cause Mr. Fleming has made no reference. This omission the Institute is constrained to notice in justice to Mr. Fleming and in justice to themselves. They may say what he has left unsaid, that his efforts have contributed in no small degree to the adoption of an initial Meridian common to all nations, and that he has unquestionably been the initiator and principal agent in the movement for reform in Time-Reckoning and in the establishment of the Universal day. The Institute cannot, perhaps, better express the debt of gratitude which the civilized world owes to Mr. Sandford Fleming in this connexion than by quoting from the accompanying paper from the pen of the distinguished Astronomer Royal of Russia, M. Otto Struve: "It is," he writes, "through Mr. Fleming's indefatigable personal labours and writings that influential individuals and Scientific Societies and Institutes in America and Europe have been won over to the cause."

It is gratifying to the Institute to be able to put forward so honourable and independent a testimony to the value of Mr. Fleming's labours in this scientific revolution, and it is also to them a source of satisfaction to reflect that Mr. Fleming's views were first communicated to the Institute, of which he is one of the earliest and most honoured members, and further, that through their printed transactions, those views were brought prominently under the notice of the scientific world.

UNIVERSAL OR COSMIC TIME.

Read before the Canadian Institute, 20th December, 1884,

BY MR. SANDFORD FLEMING, C.M.G.

On the first day of the month, the President of the United States, in his message at the opening of Congress, referred to the International Meridian Conference lately convened in Washington, in the following words :—"The conference concluded its labours on the first of November, having with substantial unanimity agreed upon the meridian of Greenwich as the starting point whence longitude is to be computed through one hundred and eighty degrees eastward and westward, and upon the adoption for all purposes for which it may be found convenient of a Universal Day, which shall begin at midnight on the initial meridian, and whose hours shall be counted from zero up to twenty-four."

The Canadian Institute is peculiarly interested in this announcement. No society, literary or scientific, has taken a more important part in the initiation of the movement to reform our Time-system, of which the success is, to some extent, indicated in the President's words. It therefore appears to me fit and proper that I should recall to your attention the various steps which from time to time have been taken, so that we may possess a record of the events which have led to the now almost general recognition of the necessity for a new notation.

Six years ago on several occasions the meetings of the Institute were engaged in discussing the subject of Time-reckoning and the selection of a Prime Meridian common to all nations. Papers were read and arguments were advanced, with the view of showing the necessity of establishing a cosmopolitan or universal time, by which the events of history might be more accurately recorded, and which would respond to the more precise demands of science, and generally satisfy the requirements of modern civilization. The proceedings of the Institute for January and February, 1879, give at considerable length the views submitted and the suggestions offered to meet the

new conditions of life. While on the one hand it was argued that the introduction of a comprehensive scheme by which time could be universally reckoned was highly desirable, it was equally maintained that the determination of a common Prime Meridian for the world was the key to its success, and that the establishment of such a meridian, as a zero, recognized by all nations, was the first important step demanded.

These proceedings were brought under the notice of His Excellency the Marquis of Lorne, then Governor-General of Canada. In the name of the Institute, they were submitted, in the form of a memorial,* with the hope that His Excellency would see fit to lay them before the Imperial Government, that they would by these means obtain the attention of the several scientific bodies throughout Europe, and that some general systematic effort would be made in the right direction to secure the important objects sought to be attained.

Through the good offices of His Excellency, copies of the Canadian Institute Proceedings found their way to the British Admiralty, the Astronomer Royal, Greenwich, The Astronomer Royal for Scotland, Edinburgh, The Royal Society, The Royal Geographical Society, The Royal Astromomical Society, The Royal United Service Institute, and other societies of eminence and weight in the United Kingdom. Copies of the papers were likewise sent through the Imperial Government to the Governments of the following countries, viz. :

FRANCE,	GERMANY,
ITALY,	NORWAY AND SWEDEN,
THE UNITED STATES,	RUSSIA,
AUSTRIA,	BELGIUM,
BRAZIL,	DENMARK,
JAPAN,	THE NETHERLANDS,
SPAIN,	PORTUGAL,
SWITZERLAND,	TURKEY,
GREECE,	CHINA.

In the year following, the American Metrological Society issued a Report of the Committee on Standard Time. The Report bears the name of Mr. Cleveland Abbe, the Chairman of the Committee, and the date of May, 1879. It draws attention to many of the causes calling for the establishment of accurate time, and the

* See page 27.

attempts made since the establishment of the electro-magnetic telegraph to make the notation of time synchronous. While pointing out that this result had been obtained in Great Britain through the efforts of Professor Airy, Mr. Cleveland Abbe gave a list of the various observatories on this continent which are in possession of the necessary apparatus and force proper to furnish astronomically accurate time by telegraph. Writing in February, 1880, while giving the resolution adopted by the society, recommending the adoption of accurate time by telegraph from an established astronomical observatory, Mr. Cleveland Abbe points out that the subject of accurate time had been taken up by the Horological Bureau of the Winchester Observatory of Yale College, and that the most perfect apparatus had been received for the purpose of distributing New York time with the highest degree of uniformity and accuracy.

Mr. Cleveland Abbe's own remarks on the subject are of high value. He forcibly points out the difficulties and inconveniences under which railway operations in America labour from the want of a proper system of time. To show this fact in greater force, he gives the seventy-four standards then followed. These several standards he proposed to set aside and replace by standards each differing one hour, or 15° of longitude.

While recommending this course, the Report sets forth that the change could only be regarded as a step towards the absolute uniformity of all time-pieces, and the Society passed resolutions, that absolute uniformity of time is desirable; that the meridian six hours west of Greenwich should be adopted as the National Standard to be used in common on all railways and telegraphs, to be known as "Railroad and Telegraph Time;" that after July 4th, 1880, such uniform Standard Time should be the legal standard for the whole country, and that the State and National Legislatures should be memorialized on the subject.

Mr. Cleveland Abbe in this report alluded to the previous proceedings of the Canadian Institute.

The active sympathy of the Marquis of Lorne greatly aided the movement of Time-reform in its early stages. In 1879, in his official position as Governor-General, he had been the recipient of the papers published by the Canadian Institute, and had transmitted them to Great Britain, and through the Imperial Government to the several European centres. In 1880, it was learned that the

Report to the American Metrological Society. above alluded to, would shortly be issued. Accordingly, advance copies were obtained from New York, and, together with additional papers issued by this Institute,* they were transmitted by His Excellency to the following European Societies, and the special attention of their members was directed to the documents themselves :

1.	The Institut de France	Paris.
2.	Société de Géographie	Paris.
3.	Société Belge de Géographie	Brussels.
4.	Königliche Preussische Akademie der Wissenschaften	Berlin.
5.	Gesellschaft für Erdkunde	Berlin.
6.	Kaiserliche Akademie der Wissenschaften	Vienna.
7.	K. K. Geographische Gesellschaft	Vienna.
8.	Nicolaevskaia Glavnaia Observatoria	Pultowa.
9.	Imper. Rousskae Geograficheskoe Obschestou	St. Petersburg.
10.	Imper. Akademia Nauk	St. Petersburg.
11.	Société de Géographie	Geneva.

By this means attention was obtained for the subject in Europe, and when I submit evidence of the fact, I think you will agree with me, that no little of the success which has attended the movement is owing to our late Governor-General. We must all acknowledge how much we are indebted to him for the great personal interest he has always shown on the subject. We are certainly warranted in forming the opinion, that the dissemination of these papers, under such distinguished auspices, awakened attention to the arguments they contain, and prepared the way for the subsequent action taken at the International Geographical Congress at Venice, at the Geodetic Congress at Rome, and more recently at the Conference at Washington.

Mr. Wilhelm Förster, director of the Berlin Observatory, enters into the subject at length in a paper "Zur Beurtheilung Einiger Zeitfragen, insbesondere gegen die Einführung einer deutschen Normalzeit." [A Review of some considerations on Time, especially against the introduction of German National Uniform Time].

Mr. Förster proceeds to say : The British Government is now transmitting, through its representatives, although at the same time it declares itself neutral, a proposition which has been published by a society of scientific men in Canada, which aims at the establishment

* See Communications printed with this.

of a cosmopolitan normal datum (Prime Meridian) and of Universal Time, and also the establishment of 24 meridians of an hour apart, by which local time will be absorbed. The first proposal Mr. Förster describes as an important sign of the times and evidently favours it.

He strongly protests against the establishment of a National German Time ; but for railway business, and for such matters of communication as require precision, also for the form of expression of all scientific relations to time, Mr. Förster points out that a Universal Time common to the whole world is to be recommended.

Dr. G. von Boguslavski, in the *Verhandlungen der Gesellschaft für Erdkunde*, (Transactions of the Geographical Society of Berlin), commends the new scheme as it has been put forth in the Canadian Institute papers, and foretells that it will be a matter of fact in a short time.

Col. Aden, Director of the Military School, Belgium, has two papers in the *Bulletin de la Société Belge de Géographie*. He supports the proposal to establish Universal Time, and expresses the opinion that longitude throughout the world should have a common notation, dating from one universally accepted Prime Meridian.

Col. Wauverman, President of the Geographical Society of Antwerp, in the Bulletin of that society, 1882, advocates the change, and with ability meets the arguments raised against it, showing them to be groundless and arising from a want of thoroughly understanding the question.

In Spain, the proposals have met with full support. All the papers issued by the Canadian Institute have been translated and published in a pamphlet of 80 pages by the Revista General de Marina. The translator, Don Juan Pastorin, an officer of the Spanish navy, is warm in his commendation of the scheme, and takes a wise and comprehensive view of the whole question. The Spanish Government secured the advantage of this gentleman's services as Delegate to the Washington Conference.

M. Otto Struve, the well-known Astronomer and Director of the Imperial Observatory, Pultowa, reports on the papers transmitted by Lord Lorne to the Imperial Academy of Science, St. Petersburg. He gives his adherence to the establishment of Universal Time, based, as suggested, on a Prime Meridian common to the whole globe, and strongly advocates counting the hours in one series up to twenty-four.

In England, the Royal Society considered favourably both the

establishment of a Universal Time and the determination of a common Prime Meridian. While the present Astronomer Royal, Mr. Christie, takes a favourable view of the question, his predecessor, Sir G. B. Airy, reported unfavourably. The report of the Astronomer Royal for Scotland, Prof. Piazzi Smith, is decidedly adverse. These documents have been transmitted to the Institute.*

In Italy, the Italian Geographical Society has given its countenance to a work by Mr. Fernando Bosari, who, in a pamphlet of 68 pages, reviews the whole question at length, and lays down three principles: 1. The determination of a Zero-meridian; 2. The establishment of Cosmopolitan Time based upon it; 3. The notation of the hours from 1 to 24 in a continuous series.

The question of Universal Time and the selection of a Prime Meridian is discussed with ability in a paper published by M. Thury, professor at the University of Geneva.

At the meeting of the Association for the Reform and Codification of the Laws of Nations at Cologne, Prussia, in 1881, the question of regulating time on the new system was considered and resolutions moved.

In the same year (1881), the subject occupied the attention of the International Geographical Congress at Venice, at which a Delegate from the Canadian Institute attended. The general question was warmly discussed, and resolutions adopted. The appointment of an International Conference to meet at Washington, specially to consider the question, was then suggested by the Canadian Delegate, and warmly supported by gentlemen representing the Government and scientific societies of the United States.* The President of the Congress communicated the resolutions to the Italian Government, and Prince Teano, on behalf of the Italian Government, undertook to conduct the official correspondence. Out of this appears to have sprung the important discussion at the meeting of the International Geodetic Association at Rome, in October, 1883, when the utility of Universal Time was recognized, and a special International Conference for the establishment of a Zero-meridian for Longitude and Time recommended.

Returning to this side of the Atlantic, the question of regulating time for railway, telegraph, and civil purposes generally, was considered at the Convention of the American Society of Civil Engineers,

* See Documents printed with this.

held at Montreal, June 15, 1881, and a committee of men engaged in the management, and familiar with the economy of railways, appointed to examine the question. The committee has reported from time to time. They recognized that a proposition to reform the general time system of the country was a problem beset with difficulties, but it did not appear to them insolvable. It was felt, however, that the question affected so many interests that any change could only be effected by general concurrence.

To attain the end proposed by this society, the papers bearing on the question were printed, and a scheme modified on the proceedings of the Canadian Institute was drawn up, under the title of "Cosmopolitan scheme for regulating time."

I may briefly recall the features of the scheme.

There should be one standard of absolute time, a Universal Day, based on the mean solar passage, at one particular meridian, the Prime or initial meridian for computing longitude. This Prime Meridian, together with the Universal Day, to be observed by all civilized nations.

There should be 24 secondary or Hour-meridians established, 15 degrees of longitude apart, beginning with the Prime Meridian as zero.

To distinguish the Universal Day from local days, it should bear the title of "Cosmic Day." *

Cosmic Time is intended to be used to promote exactness in chronology, and to be employed in astronomy, navigation, meteorology and in synchronous observations throughout the world. To be employed in ocean telegraphy and generally in all operations non-local in character.

The several twenty-four Meridians to be used as standards for local time around the globe. Applying the system to North America, the effect would be to reduce tbe standards to four or five, as suggested by the Metrological Society.

A circular, dated March 15th, 1882, signed by Mr. John Bogart, the Secretary of the American Society of Civil Engineers, was for-

* [Note.—I may remark, that the designation "Cosmic" was first suggested, independently, by two Canadian gentlemen widely separated, by Mr. R. G. Haliburton, then in Algiers, and by Mr. Thomas Hector, of Ottawa. The etymology commends the use of the word. It has been accepted by a number of societies and by many individuals as appropriate and applicable.]

warded to the leading men in railway direction, either as general managers, superintendents or engineers, and to men of scientific attainments throughout the United States and Canada. The papers thus circulated contained eleven questions, and categorical replies were invited to them.

Replies were received and reported on at a Convention of the Society, held in Washington on the 17th May, 1882. The scheme submitted was generally and cordially approved.

An emphatic and unanimous opinion was expressed, that there should be established as early as possible a comprehensive system of Standard Time for North America.

Of those who replied to the queries, ninety-five per cent. favoured the idea that there should be a common agreement between the Standards of Time in all countries. That while we must primarily look to our own convenience on this continent, it is proper to aim at eventually attaining general uniformity among all nations.

Seventy-six per cent. were in favour of reducing the Standards in North America so that they would differ only by intervals of one hour, and ninety-two per cent. were in favour of a notation of the hours of the day in a single series from 1 to 24, instead of in two divisions, each of twelve hours.

The character of the replies received indicated that a remarkable unanimity of opinion prevailed in every section of the continent heard from. The Convention accordingly resolved that an attempt should be made to obtain European concurrence to the selection of a Prime Meridian on which a Time-system could be definitely based. But, failing to obtain this recognition, the people of the Western Continent should determine a Zero-meridian for their own use and guidance.

It was thereupon resolved to petition the Congress of the United States to take the matter into consideration. The American Metrological Society about the same time adopted a similar proceeding. The consequences were that a Joint-resolution of the House of Representatives and the Senate was passed, authorizing the President of the United States to call an International Conference to fix on and recommend for universal adoption a common Prime Meridian to be used in the reckoning of Longitude and in the regulation of Time throughout the world.

On the meeting of the American Association for the Advancement

of Science in Montreal, in July, 1882, the subject was brought forward, and all the documents were submitted and discussed. It was agreed that the Association should co-operate with other bodies in furtherance of the movement.

On two occasions the Royal Society of Canada has had its attention directed to the matter, and this body has assisted in furthering the determination of the problem by its co-operation and by correspondence with the Government.

While some delay took place in summoning the International Conference by the President, in consequence of diplomatic correspondence on the subject, the question was ripening on both sides of the Atlantic for concerted action. Indeed, a decision with respect to the regulation of local Time was anticipated by the Railway authorities in North America, who adopted the system of Hour-standards which had been prominently brought forward as described.

On November 18th of last year (1883) the new system of regulating railway Time on this continent came into operation. There had been several preliminary meetings of railway managers; the last meeting was a Convention held in Chicago the previous October, and it was then determined immediately to carry out the change.

Mr. W. F. Allen, the secretary of this Convention, who also took a prominent part in effecting the adoption of the change, has given a history of the events leading to it. Upon this gentleman mainly fell the labour of arranging details, and he executed the difficult duties assigned to him with consummate ability. In the words of the historian, the transition from the old to the new system "was put into effect without any appreciable jar, and without a single accident occurring." According to this authority the first newspaper to advocate some change was the *Railroad Gazette* for April 2, 1870, and it is claimed that as early as 1869 Prof. Charles F. Dowd, Principal of Temple Grove Ladies' Seminary, Saratoga Springs, proposed a system of meridians based on the meridian of Washington at intervals of one hour, by which railways should be operated, and that an expression of his views was placed in the hands of the President of the New York and Canada Railroad. The proposition appears to have attracted attention in the *Travellers' Official Guide* of 1872. In 1873 it was brought before the Railway Association of America, not now in existence. A committee was appointed to examine into its merits; they failed to recognize its necessity, and

recommended that the question of National Standard Time for use on Railways be deferred until it more clearly appeared that the public interests called for it.

Mr. Dowd's efforts to introduce a National Standard Time to meet the difficulties which were being developed were at the time imperfectly appreciated. He, however, has had the satisfaction of seeing a scheme unanimously accepted, and put in operation, which in essential features does not materially differ from that which he advocated; and he himself attended at the meeting of the American Metrological Society, and took part in the proceedings when the details of the new Time arrangements were officially narrated.

Prominent among those who have earnestly laboured to advance the movement of Time-reform is the distinguished President of Columbia College, New York. Dr. Barnard has from the first taken the deepest interest in the question, and few men have done so much to bring it to a practical issue. In the proceedings of the American Metrological Society for 1881 will be found a paper prepared by Dr. Barnard in 1872, and presented to an association which has since assumed an international character, and is known as the association for the Reform and Codification of the Laws of Nations. In this paper Dr. Barnard recommends the selection of Greenwich as the Prime Meridian for the world, and he submits the views he held at that early date, which at this hour are of peculiar interest. He points out that "it is becoming a matter of greater importance every day that there should be established some universal rule for defining the calendar day for all the world."

I have alluded to the valuable report of Professor Cleveland Abbe, of the United States Signal Service, to the Metrological Society, and I cannot deny myself the pleasure of acknowledging the services of the gentlemen with whom I have been associated on the special committee on Standard Time of the American Society of Civil Engineers, Mr. Charles Paine, of New York; Mr. Theodore N. Ely, of Altoona, Pennsylvania; Mr. J. M. Toucey, of the Hudson River Railway; Professor Hilgard, Coast Survey, Washington; Professor T. Egleston, of Columbia College; General T. G. Ellis, of Hartford, now unfortunately deceased, and Mr. John Bogart, Secretary of the Society,

The American Society of Civil Engineers, since meeting in Montreal, in 1881, has made persistent and continuous efforts in the common interest to advance the movement of Time-reform, having

greatly aided in bringing about the important change carried into effect a year ago. This Society is now directing attention to a reform of scarcely less importance, the notation of the hours of the day. At the Buffalo convention in June last, this particular question received prominent consideration in the address of the President, as well as in the report of the special committee.* Since that date a correspondence has taken place between the Secretary and the railway managers in the United States and Canada. Already replies have been received from the representatives of some sixty thousand miles of railway, ninety-eight (98) per cent. of whom have given expression to their sympathy with the movement, to abandon the old practice of halving the day, designating the two sets of twelve hours by the abbreviations A.M. and P.M., and are prepared to adopt a simple notation of 1 to 24 in a single series. The great telegraph interests of the country are likewise in full sympathy with it. The President of the Western Union Telegraph Company, Dr. Norwin Green, states that their telegraphic traffic is equal to the transmission of forty-four million messages a year, and the general adoption of the 24 o'clock system (as it has been designated), would be cordially welcomed by telegraphers. It would reduce materially the risk of errors, and to the company over which he presides, he says it would save the transmission by telegraph of at least 150,000,000 letters annually.

The branch literature bearing on the two questions of Universal Time and the establishment of a Prime Meridian, has been enriched by a series of papers which have appeared during the past year in the *International Standard*, a magazine published in Cleveland, Ohio. These papers are by the following gentlemen connected with

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* In "Nature" (London) of November 13th, the following appears:—"However long the "use of the 'a. m.' and 'p. m.' for distinguishing the two halves of the civil day may survive, "it seems probable that the more rational method of counting the hours of the day continu- "ously from midnight through twenty-four hours to the midnight following, may before long "come into use for a variety of purposes for which it is well adapted, even if it should not yet "be generally employed. It seems proper, therefore, to consider in what way ordinary watches "and clocks could be best accommodated to such a change in the mode of reckoning. To place "twenty-four hours on one circle round the dial, instead of twelve hours, as at present, seems "the most natural change to make; but in addition to a new dial, it would involve also some "alteration in construction, since the hour-hand would have to make one revolution only in the twenty-four hours instead of two. And there would be this further disadvantage, that the "hours being more crowded together, the angular motion of the hand in moving through the "space corresponding to an hour would be less—in fact, one-half of its present amount." The remedy pointed out in "Nature" is extremely simple. It is the same as that recommended by Committee on Standard Time of the American Society of Civil Engineers, who reported at Convention of the Society at Buffalo in June (1884) as follows:—"It is proposed to adapt

the International Institute :—Rev. H. G. Wood, of Sharon, Pennsylvania ; Professor C. Piazzi Smyth, Astronomer Royal for Scotland ; Professor John N. Stockwell, Astronomer, Cleveland ; Mr. Jacob M. Clark, C.E., New York ; Mr. William H. Searle, Pennsylvania ; the late Abbé F. Moigno, Canon of St. Denis, Paris ; Commodore Wm. B. Whiting, U. S. Navy ; Mr. Charles Latimer, C. E., Cleveland ; and others.

It will be seen from what I have submitted, that the proceedings have neither been few nor without success, and that since this Institute published the first issue of papers on Time and Time-reckoning, the subject has received much attention on both sides of the Atlantic. Societies with kindred pursuits, men of recognized merit in the scientific world, have turned to its examination and aided in its development. Some few men have acted in concert. The labours of others have been independent. Some of these names I have been able to record, but I fear that I neglect to include many of eminence because they are not known to me. It is this varied and widely diffused effort which has rendered possible the realization of the practical results which I have the gratification to record, and all

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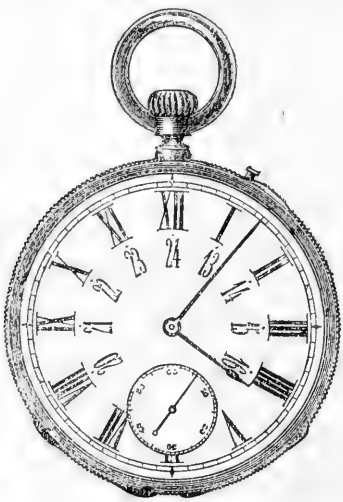
" clocks and watches now in use to the change by inscribing on the existing dials the new " numbers of the afternoon hours – thirteen to twenty-four (13 to 24) inclusive—as in the Plate " No. 1.

Plate  No. I.

The only practical difficulty to be overcome is met by the simple expedient of placing on

the members of this Society must equally join in the common satisfaction in the measure of success which has been achieved.

Six years back, when the subject was discussed in this Hall, there were probably not a few who viewed the propositions then submitted as merely fanciful theories. Others, who did not refuse to recognize their bearing, entertained the feeling that many grave difficulties presented themselves to interfere with any successful attempt to reform or modify usages so ancient as the computation of time. But the Institute, as a body, was hopeful. The action taken by the Council to extend the field of discussion and awaken the attention of foreign communities, evinced confidence, and we may now ask, was this confidence justified? What are the facts to-day? Twelve months have passed since an important change in the notation of Railway Time was made with general approval throughout the length and breadth of North America; a revolution in the usages of sixty millions of people has been silently effected and with scarcely a trace that it has happened. That proceeding has been followed by events of equal importance. On the 1st of October last a body of accredited Delegates from the different nations, on the invitation of the President of the United States, met in Conference to consider the problem

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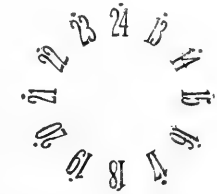
" the face of the watch or clock a secondary dial, showing the new afternoon hours in Arabic " numerals within the present Roman figures.

Plate  No. 2.

" Plate No. 2 shows the secondary dial. It must be of thin material; and it has been " found that made simply of paper and secured to its position by any gum which will adhere to " an enamelled surface, the object is attained without any further alteration of the watch or " clock.

" The Committee is aware that these seem trifling matters to bring under the notice of the " Convention, but questions of great moment not seldom hinge on small details. It is evident " from what has been set forth, that every person in the community may, at the cost of a few " cents in each case, adapt his watch to the 24 o'clock system.

" The Committee accordingly repeat their conviction, that with the disappearance of the " only practical difficulty at an insignificant cost, there is nothing to prevent the Railway " authorities and the community at large adopting the change as soon as they become alive to " its advantages."

first submitted to the world by this Institute. The delegates were the representatives of twenty-five (25) civilized nations. The Conference continued during the whole month of October, and, as a body, they came to conclusions affecting all peoples living under our theories of civilization.

It was early understood that a determination with respect to Universal Time was not possible without the general recognition of a Prime Meridian. Hence the importance attached to its choice, that it should be universally accepted.

For many years attempts have been made to effect the establishment of an initial meridian recognized in common by all nations, but every attempt hitherto had proved completely unsuccessful. It is therefore the greater cause for congratulation, that the efforts of the Washington Conference have succeeded in its determination.

The discussions of the Conference were long, and being carried on in different languages, could not have been of equal interest to all present. Translations became necessary, so that all the Delegates might equally understand the propositions which were daily submitted. This necessary course prolonged the sessions and multiplied the adjournments. At last, however, the choice of a Prime Meridian was obtained. The following resolution was passed, the Delegates voting by nations :

"*Resolved*, That the Conference proposes to the Governments here represented, the adoption of the meridian passing through the centre of the transit instrument at the Observatory of Greenwich as the initial meridian for longitude.

The above resolution was adopted by the following vote :

In the affirmative :

AUSTRIA,	MEXICO,
CHILI,	NETHERLANDS,
COLOMBIA,	PARAGUAY,
COSTA RICA,	RUSSIA,
GERMANY,	SALVADOR,
GREAT BRITAIN,	SPAIN,
GUATEMALA,	SWEDEN,
HAWAII,	SWITZERLAND,

ITALY,	TURKEY,
JAPAN,	UNITED STATES,
LIBERIA,	VENEZUELA.

In the negative :

SAN DOMINGO.

Abstained from voting :

FRANCE AND BRAZIL.

AYES 22. NOES 1.

There was less difficulty and even greater unanimity displayed when the consideration of Universal Time was submitted. The Conference adopted the principle of a Universal Day without a single negative vote. The resolutions carried are substantially in accord with the essential principles, if not with the precise features of the proposals set forth in the proceedings of the Canadian Institute, published in 1879.

The resolution defining the Universal Day reads as follows : "*Resolved*, That this Universal Day is to be a mean solar day ; is to begin for all the world at the moment of mean midnight of the initial meridian, coinciding with the beginning of the civil day and date of that meridian, and is to be counted from zero up to twenty-four hours."

This definition, taken in conjunction with the other resolutions of the Conference, is fraught with important consequences.

When it is mean midnight at Greenwich, that moment it is mean noon at the meridian 180° from Greenwich, as indicated by the solar passage. Hence the Anti-Prime Meridian practically becomes the Time-zero for the world.

The initial instant of the twenty-four hours of each successive Universal or Cosmic Day is the moment of mean solar passage on the Anti-Prime Meridian. The first hour of the Cosmic Day is at the solar passage on the meridian 15° westward ; this then becomes the 1st Hour Meridian. The second hour of the Cosmic Day is at the solar passage on the meridian 15° still further westward ; this becomes the 2nd Hour Meridian. And so on in turn, each meridian which is an exact multiple of 15° from the Time-zero becomes an Hour Meridian corresponding in number with the numbers of the successive hours of the Cosmic Day.

The twenty-four Hour Meridians so determined come in the following order, viz. :

LONGITUDE EAST AND WEST.	HOUR MERIDIANS.	COSMIC TIME AT SOLAR PASSAGE.
180° Anti-Prime Meridian	Zero	0 hours 0 minutes.
165° East	1st Hour Meridian	1 o'clock.
150° East	2nd " "	2 "
135° East	3rd " "	3 "
120° East	4th " "	4 "
105° East	5th " "	5 "
90° East	6th " "	6 "
75° East	7th " "	7 "
60° East	8th " "	8 "
45° East	9th " "	9 "
30° East	10th " "	10 "
15° East	11th " "	11 "
0° The Prime Meridian	12th " "	12 "
15° West	13th " "	13 "
30° West	14th " "	14 "
45° West	15th " "	15 "
60° West	16th " "	16 "
75° West	17th " "	17 "
90° West	18th " "	18 "
105° West	19th " "	19 "
120° West	20th " "	20 "
135° West	21st " "	21 "
150° West	22nd " "	22 "
165° West	23rd " "	23 "
180° Anti-Prime Meridian	24th " " or zero	24 "

Thus the exact position of the twenty-four secondary or Hour Meridians is practically determined, and provision is thereby made for extending around the globe the Hour-system of regulating time which has been adopted with so much advantage in America.

These Hour Meridians, so designated, completely establish the relation between Cosmic time and longitude. Once every day the relationship will be prominently brought under the notice of every individual. Everyone, for example, living on the 6th Hour Meridian, will know at noon that it is at that instant six o'clock Cosmic time ; or, take the citizens of Toronto, the local time of which is governed by the 17th Hour Meridian ; at the hour of noon they will know that it is 17 o'clock Cosmic Time. Invariable time will thus agree with longitude, conversely longitude with time. By this arrangement the earth itself becomes the great Standard Chronometer for all

mankind, and in its daily rotations the passage of the sun at any spot will be the index of Cosmic time.

The resolutions of the International Conference establish a means of reckoning time which promises, in the years to come, to be of the highest advantage to the human family. Cosmic Time, or whatever name may be given to Universal Time applied to civil purposes, is an entirely new feature. It has now obtained recognition by a properly constituted authority, although until recently, I believe, it has remained unconsidered. Astronomers have long had equinoctial time, which is absolute time, dating from an epoch determined by the sun's motion among the stars ; beyond this I cannot find any nearer approach to the mention of Universal Time as now understood.

The conclusions of the Conference mark a new era. The civil time of England is adopted as Universal Time. It may be said that Greenwich time is already known on every sea, that it has been carried by British ships wherever British explorers and colonists and merchants have penetrated, but Greenwich time is the local time of Greenwich, and, heretofore, it has always been held as such. Universal time, based on the Prime Meridian of the globe, and recognized by the several civilized nations, is an entirely different conception. As the Time of the world common to every nation, it is held that the term "Cosmic" will better express that meaning than "Greenwich." Cosmic and Greenwich time are identical by accident, but the expressions imply two totally different ideas, and known national sensitiveness suggests the good taste and expediency of distinguishing the two ideas by different terms.

I am induced to add a few words in explanation of the principles of Cosmic time.

Time has been the subject of profound thought by many philosophic minds of the past. They have attempted to define it, and their definitions have been manifold. If we view the earth as a whole, and the conditions of the age in which we live oblige us so to view it, I am unable to see that any one of the recorded definitions gives support to the ancient system of keeping count of time which we follow. Our ordinary usages imply that there is an infinite number of times, and they are based on the principle that time is dependent on local situation. Nothing can be more erroneous and misleading. It is this false principle entering into every detail of daily life which has led each insignificant locality on the circumference of the globe to

claim the right to have its own time. It is self-evident that time is in no way dependent on locality, and I will quote on this point but one authority, the great Sir Isaac Newton. "Absolute true and mathematical time of itself, and from its own nature, flows equally without regard to anything external."

Our finite minds are incapable of understanding fully what time is, but this much is perfectly clear to our reason. Time is a measureable quantity, it may be termed a flowing magnitude, and only as *one* such magnitude is it conceivable. A distinct and separate flow of time in each of the myriad localities throughout the Universe is perfectly inconceivable. If time be anything it is a *unity* and not a *plurality*. The cardinal principle of Cosmic Time is *unity*, and with *unity* as a fundamental idea of time it must be held that the Cosmic system is the only sound principle of reckoning, and that as the area of civilization broadens, it must in the end be recognized as applicable everywhere and for all purposes.

The conclusions of the International Conference are fruitful of results of high importance. They may be said to point to the opening of a new chapter in the world's annals. They make provision for a complete cessation of ambiguity in hours and dates. By Cosmic Time all events whatsoever will be systematically arranged according to their proper chronological order. The calendar days the world over will begin at the one initial instant, and clocks will strike the same hour at the same moment in all longitudes.

But the new system can only be gradually introduced. The majority of mankind have firmly fixed ideas with regard to the passage of the day and the numbers of the hours by which their social habits are regulated. A proposal suddenly to change the old familiar succession of the hours will be misunderstood. The influence of custom is always powerful under any aspect. It is anticipated that this influence will be the one serious obstacle to be overcome. The belief, however, may be permitted that the change will be rendered easy when men understand that the numbers of such hours have been arbitrarily chosen; that there is no necessary connection between them and the position of the sun in relation to the earth in its daily rotation, and that whatever numbers may distinguish the twenty-four divisions of the day, the recurring phenomena of light and darkness will always regulate sleeping, waking, eating, and working, and all the routine of life in every locality. Noon has heretofore been

associated in our minds with the hour of 12, but among the Jews noon was the 6th hour, and astronomers have almost invariably recognized it as the 24th hour. For a year back throughout the United States and Canada the agreement between 12 o'clock and precise noon has been at an end. It may be said that, except on four or five meridians, 12 o'clock is nowhere coincident with mean solar noon. This departure from an old usage must tend to unloosen the traditional idea that the mere numbers of the hours have any necessary connection with the position of the sun in the heavens. If this innovation has any effect it must help to pave the way for still further and more important changes than have yet been introduced. The Meridians by which time is regulated in North America are 5, 6, 7 and 8 hours of longitude west from the Prime Meridian. It will only be necessary to move forward our clocks 5, 6, 7, and 8 hours respectively to bring them all into agreement with the time of the Prime Meridian, which is Cosmic Time, and thus obtain complete uniformity. It cannot, however, be looked for that Cosmic Time will at once be adopted in ordinary affairs. A generation probably will pass away before it will obtain general acceptance. The difficulties to be overcome cannot be ignored, and we may assume that it will only be step by step that the change will be made, the more advanced nations taking the lead. On this continent positive progress has been made, to be succeeded before long, I do not doubt, by another advance in public opinion, and a general acceptance of the principles recently recognized. In the course of years the prejudices engendered by inherited customs will be greatly modified, and the masses will gradually have their minds familiarized with new ideas. It is a significant fact that the principles of the new system should be unanimously recommended by delegates from all civilized nations. I do not doubt that the several peoples they represent will sooner or later understand that one uniform reckoning of time for every purpose throughout the globe is the only rational system, and the one notation which in coming years will properly meet the necessities and requirements of mankind.

In these remarks I have narrated the events which have taken place on both sides of the Atlantic to influence and determine the conclusions which, a few weeks back, the President submitted to the Congress of the United States.

On this occasion I cannot think that I am entirely wrong when I

venture to congratulate the Canadian Institute on the part which it has taken in the solution of this problem. It stands among the Societies who first considered this comparatively new question. Indeed, it may be claimed that the Institute is to some extent the pioneer Society in awakening the world to the advantages to be derived from the establishment of Cosmic Time..

In conclusion, I will avail myself of the words of an early President of the Institute, whose portrait for more than thirty years has adorned the hall in which we are now assembled. Referring to the results already effected in Time-reform and the prospects for the future, General Sir Henry Lefroy, in his address at the late meeting of the British Association in Montreal, remarked: "Whether we conceive its educational tendency or its influence on the future intercourse of unborn millions, it is a somewhat remarkable evidence that agreement upon questions of general concern is not that unattainable thing which we are apt to consider it."

After the reading of Mr. Fleming's paper, the following Resolution was moved by Dr. E. A. Meredith, seconded by Mr. W. H. VanderSmissen, and passed:

"That the meeting, considering this an exceptional case, desire to tender a cordial vote of thanks to Mr. Sandford Fleming, C.M.G., for his interesting communication on the subject of 'Cosmic Time,' and they wish, at the same time, to record their satisfaction that to one of the original members of the Institute is due the honour of being the first to bring prominently before the scientific world, through the medium of the Journal of the Institute, the important subject of Time Reform, and the adoption of uniform or Cosmic Time."

COSMIC TIME.

SUPPLEMENTARY PAPERS,

COMMUNICATIONS AND REPORTS,

IN THE POSSESSION OF

THE CANADIAN INSTITUTE.

SUPPLEMENTARY PAPERS.

MEMORIAL OF THE CANADIAN INSTITUTE TO HIS EXCELLENCY THE GOVERNOR-GENERAL OF CANADA, SUBMITTING PAPERS ON TIME-RECKONING AND A PRIME MERIDIAN, READ DURING THE SESSION 1878-79.

To His Excellency, the Right Honourable SIR JOHN DOUGLAS SUTHERLAND, *Marquis of Lorne, one of Her Majesty's Privy Council, Knight of the Most Ancient and Most Noble Order of the Thistle, and Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Governor-General of Canada, and Vice-Admiral of the same.*

The memorial of the Council of the Canadian Institute

RESPECTFULLY SHEWETH :

That the Canadian Institute, established in Toronto for a period of thirty years, has specially aimed at promoting scientific study and research; and by means of its Journal of Proceedings has maintained communication with men of science in Europe and America.

At meetings of the Institute, during the present session, communications have been submitted to it by one of its members, Mr. Sandford Fleming, C. M. G., with the special object of determining a First or Prime Meridian, common to all nations; and promoting the adoption of a universal system of Time-reckoning, adapted alike to the requirements of an uniform historical record, and to the novel requirements of civilization, consequent on the rapid extension of railway and telegraphic lines over the globe.

While the geographical circumstances of Canada invest this subject with peculiar interest to the Dominion, its importance is not limited to Canada. In every civilized country, circumstances have tended in recent years to demonstrate the desirableness of adopting some uniform system of notation of time and space; and, as your Excellency will see by the papers herewith transmitted to you, the attention of various scientific bodies, both in Europe and America, as well as of your memorialists, has been directed to this important subject.

Your Memorialists have accordingly welcomed, with special satisfaction, the suggestion by one of their own members whose practical experience, especially in his trans-continental surveys as Chief Engineer of the Canadian Pacific Railway, peculiarly fits him for the task: the suggestion of a Prime Meridian, free from the objections hitherto urged against other propositions, and so offering an accept-

able solution of a problem of international importance, which has long engaged the attention of leading geographers and astronomers both of Europe and America.

As the determining one initial Meridian for computing longitude, common to all nations, is an object of special interest to Great Britain, as the foremost maritime nation of the world, as well as to Canada and all the Colonies of the Empire: the Council of the Canadian Institute have hoped that the subject will not seem unworthy of your Excellency's consideration.

They respectfully invite your attention to the matter as set forth in the accompanying papers; and in view of the important international interests involved, they beg leave, very respectfully, to ask your Excellency to bring the subject under the notice of the Imperial Government, and to use your high influence to direct the attention of official and scientific authorities in Great Britain, and those of foreign Governments, to it.

The peculiarly favourable position which your Excellency occupies as the Governor-General, under Her Majesty, of a Dominion commanding both the Atlantic and Pacific coasts of the Continent of North America, appears to your Memorialists to furnish special facilities for promoting the simplification of a complex system, admittedly open to well-founded objections; and substituting for it one which not only offers a solution of the evils, but is also extremely simple in its application, and free from the sources of international jealousy which have hitherto neutralized the efforts of scientific men to remedy practical evils which are universally recognized.

And your Memorialists, as in duty bound, will ever pray.

DANIEL WILSON, LL. D., *President.*
WM. OLDRIGHT, M. A., M. D., *2nd Vice-President.*
HENRY SCADDING, D. D., *3rd Vice-President.*
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E. J. CHAPMAN, LL. D.
JAMES LOUDON, M. A.

HIS EXCELLENCY THE MARQUIS OF LORNE, GOVERNOR-GENERAL OF CANADA, TO SIR M. E. HICKS-BEACH, SECRETARY OF STATE FOR THE COLONIES.

[No. 147.] OTTAWA, 21st May, 1879.

SIR, I have the honour to forward herewith for such action as you may think proper a copy of a Memorial addressed to me from the Canadian Institute, Toronto, together with a pamphlet with respect to the desirability of establishing a "Prime Meridian" to be common to all nations.

I have, etc.,
LORNE.

SIR M. E. HICKS-BEACH, &c., &c.

MEMORANDUM OF THE CANADIAN INSTITUTE, ACCOMPANYING PAPERS TRANSMITTED TO THE IMPERIAL GOVERNMENT BY HIS EXCELLENCY THE GOVERNOR-GENERAL, CANADA, MAY, 1879.

The President and Council of the CANADIAN INSTITUTE (Toronto), having memorialized His Excellency the Governor-General of Canada, respecting the accompanying papers, with the special object of determining a FIRST OR PRIME MERIDIAN TO BE COMMON TO ALL NATIONS, and promoting the adoption of a UNIVERSAL SYSTEM OF TIME-RECKONING, adapted to the requirements of modern progress:

His Excellency the Governor-General, in view of the important international interests involved, has been graciously pleased to bring the subject under the notice of the Imperial Government, in order that the attention of the official and scientific authorities of Great Britain and of foreign countries may be directed to it.

The geographical circumstances of this country invest the question with special interest to the people of Canada, and the peculiar political status of the Dominion may in some respects enable the representatives of Canadian science to mediate, especially between their scientific brethren, in the various countries more immediately interested in the questions at issue. The Council of the Canadian Institute will be glad to receive, and to transmit to all the scientific bodies with which they interchange publications, any communications which may be made to them; and with the view of promoting the objects aimed at, will be happy to collate all comments, suggestions, or expressions of opinion with which they may be favoured.

R. RAMSAY WRIGHT,
Secretary.

CANADIAN INSTITUTE,
Toronto, May, 1879.

PROFESSOR R. RAMSAY WRIGHT, SECRETARY OF THE CANADIAN INSTITUTE, TO HIS EXCELLENCY THE GOVERNOR-GENERAL, CANADA.

CANADIAN INSTITUTE, TORONTO, June 24th, 1879.

The Secretary of His Excellency the Governor-General, Ottawa.

SIR,—Referring to the papers on Time-reckoning and the selection of a Common Meridian, which His Excellency has been pleased to bring under the notice of the Imperial Government, in order that the attention of the Scientific and other authorities of various countries may be directed to the subject,

I now beg to forward to you additional copies, in order that they may be transmitted, through the Imperial Government, to the proper official authorities and the principal Scientific Societies in Great Britain and the Colonies, as well as to the representatives in London of the different countries in the accompanying list.

I am requested respectfully to express the hope that in directing attention to these papers it may be intimated that the Council of the Canadian Institute will be glad to learn how far the solutions of the difficulties referred to may be generally acceptable.

I have the honor, etc.,

R. RAMSAY WRIGHT,

Secretary.

FOREIGN COUNTRIES.

France	8 copies.
Germany	8 "
Italy	8 "
Norway and Sweden	8 "
The United States	8 "
Russia	8 "
Austria	4 "
Belgium	4 "
Brazil	4 "
Denmark	4 "
Japan	4 "
Netherlands	4 "
Portugal	4 "
Spain	4 "
Switzerland	4 "
Turkey	4 "
Greece	4 "
China	4 "

IN GREAT BRITAIN.

The Admiralty	50 copies.
The Astronomer Royal, Greenwich	
The Astronomer Royal for Scotland	
Royal Astronomical Society	
Royal Geographical Society	
Royal United Service	
Royal Society	

HIS EXCELLENCY THE MARQUIS OF LORNE, GOVERNOR-GENERAL OF CANADA, TO SIR M. E. HICKS-BEACH, COLONIAL SECRETARY, LONDON.

[No. 174.] OTTAWA, July 12th, 1879.

SIR,—With reference to my despatch No. 147, of the 21st May last, transmitting a copy of a pamphlet, entitled "Time-reckoning and the Establishment of a Prime Meridian," I have the honour to forward herewith a further communication, June 24th, 1879, from the Canadian Institute at Toronto, concerning additional copies of the papers in question, and requesting that they may be distributed in accordance with the list appended.

If you see no objections I should be much obliged if you would kindly give effect to the wishes of the Institute.

I have, etc.,
LORNE.

SIR M. E. HICKS-BEACH, &c., &c.

SIR M. E. HICKS-BEACH, COLONIAL SECRETARY, LONDON, TO THE MARQUIS OF LORNE, GOVERNOR-GENERAL, CANADA.

[Canada, No. 342.] DOWNING STREET, 15th October, 1879.

MY LORD,—In my despatch, No. 173, of the 11th of June, I acknowledged the receipt of your despatch, No. 147, of the 21st of May, inclosing a Memorial from the Canadian Institute of Toronto, together with a Pamphlet, entitled "Time Reckoning and the Establishment of a Prime Meridian," which the memoralists desired to be brought to the notice of Her Majesty's Government as well as of Scientific Societies in Great Britain, and to be submitted also for the consideration of the Governments of Foreign Powers.

2. I have now to acknowledge your later despatch, No. 174, of the 12th of July, inclosing a further communication from the Canadian Institute, forwarding additional copies of the Pamphlet, which they request may be distributed in accordance with a list thereto appended.

3. It has been the custom of Her Majesty's Government to abstain from interfering with recognized usages in questions of social importance until the spontaneous use of any novel system that may be introduced in such matters has become so extensive as to make it desirable that authoritative regulations should be sanctioned with regard to it, and it does not appear that such a condition of affairs in reference to the subjects of the Memorial has yet arisen.

4. It appears, however, that the memorialists consider it desirable that their views on the question should be extensively ventilated, and in accordance with their application, I have forwarded the Pamphlets which they have transmitted, to the scientific societies named in the list, and I will also request the Secretary of State for Foreign Affairs

to transmit copies of the Pamphlet to the Representatives of Foreign Countries, as desired, and to intimate to them that I shall be happy to forward to the Canadian Institute any communications which may be sent in reply from any Foreign Scientific Institutions to which they may be forwarded, but it must be distinctly understood that Her Majesty's Government are merely transmitting these papers out of courtesy to a Scientific Institution in Canada, and that in doing so, they lend no support to, and assume no responsibility for the views advocated therein.

I have, &c., &c.,

M. E. HICKS-BEACH.

GOVERNOR-GENERAL,

The Right Hon. The Marquis of Lorne, K.T., G.C.M.G., &c.

SIR M. E. HICKS-BEACH, COLONIAL SECRETARY, LONDON, TO THE MARQUIS OF LORNE, GOVERNOR-GENERAL, CANADA.

[Canada, 343.] DOWNING STREET, 17th October, 1879.

MY LORD,—With reference to my despatch, No. 342, of the 15th instant, relating to the pamphlet on "Time Reckoning and the Selection of a Common Meridian," which the Canadian Institute of Toronto has desired to have brought before the notice of various Scientific Societies and of Foreign Governments, I have the honour to transmit to you the accompanying copies of letters received from the Admiralty and from certain of the scientific bodies to whom copies of the Pamphlet were forwarded, in accordance with the wish expressed in your despatch, No. 174, of the 12th of July last.

I request that these documents may be forwarded for the information of the Canadian Institute of Toronto.

I have, &c., &c.,

M. E. HICKS-BEACH.

GOVERNOR-GENERAL,

The Right Hon. The Marquis of Lorne, K.T., G.C.M.G., &c.

SIR G. B. AIRY, ASTRONOMER ROYAL, GREENWICH, TO THE SECRETARY OF STATE FOR THE COLONIES.

(PORTINSCALE, KESWICK),
ROYAL OBSERVATORY, GREENWICH, 18th June, 1879.

SIR,—I have the honour to acknowledge your letter of June 13th, transmitting to me copy of a Memorial, undated, from the Council of the Canadian Institute of Toronto to the Governor-General of Canada, together with a Pamphlet by Mr. Sandford Fleming, which I return herewith, and requesting my observations or suggestions on these documents. I respectfully offer the following remarks:

1. The subject of the Pamphlet is "Time Reckoning and a Prime Meridian common to all Nations," on this matter I advance: First,

that in all countries in which hours are known, the origin of those hours is, approximately, the mean time of local noon. There must thus be introduced a degree of confusion, which the ordinary sense of mankind, by maintaining (in adjustments of public clocks, &c.,) the same mean origin within definite limits, and well defined differences between the indications in territories of other definite limits, has effectually met. Thus the difference between England and Ireland has been fairly met by a difference of 25^m (which would better have been 30^m) between the indications of the public clocks. It is, I believe, certain that this is not the result of legislation, it appears to be merely the result of common sense, guided perhaps by a single personal influence. At Basle (possibly in like manner at other stations) the great systems of the French Railways meet, and there the times in the French States and the German States (I suppose Paris time and Berlin time), are exhibited side by side, and there can be no confusion or difficulty. In the case of the railway from New York to San Francisco, it is merely necessary to frame the Westward train-bills and guard's watches to New York time, and the Eastward train-bills and guard's watches to San Francisco time, with double clocks at every station, naturally there must be a re-adjustment of watches at the end of the journey. Thus, adopting as incontrovertible the idea that every district will refer to visible noon for the origin of its own time, and remarking the extreme facility with which those origins can be linked together, I set not the slightest value on the remarks extending through the early parts of Mr. Fleming's paper. Secondly, as to the need of a Prime Meridian, no practical man ever wants such a thing. If a Prime Meridian were to be adopted, it must be that of Greenwich, for the navigation of almost the whole world depends on calculations founded on that of Greenwich. Nearly all navigation is based on the Nautical Almanac, which is based on Greenwich observations and referred to Greenwich Meridian, and the number of Nautical Almanacs sold annually exceeds, I believe, 32,000 (see the Navy Estimates). But I, as Superintendent of the Greenwich Observatory, entirely repudiate the idea of founding any claim on this. Let Greenwich do her best to maintain her high position in administering to the longitude of the world, and Nautical Almanacs do their best, and we will unite our efforts without special claim to the fictitious honour of a Prime Meridian.* For the mere expression of longitudes, with the limitation that longitude is not to exceed 180° East or West, Greenwich is not inconvenient. But every such consideration yields to historical or other circumstances. Thus, as regards California civilization and time-reckoning (in the count of days of a month)

* The origin of Greenwich Observatory is curious. A Frenchman had a correct idea that longitude at sea might be determined by observations of the moon. He was not received by Louis XIV., but procured introduction to the Duchess of Portsmouth, who placed his scheme before Charles II. and his brother James, both able men in some respects. They adopted it, in essentials, and Greenwich Observatory was founded. The moon is still the most important object of the Greenwich Observatory.

were first carried eastwardly from Europe to California, through the Cape of Good Hope and India (by the Jesuit Missionaries). When the United States advanced westwardly, they who had taken their count westwardly from Europe found one day's difference. The United States have gained the victory in the States. I know not whether the Missions have changed. It is said that the Philippine Islands are still in an anomalous position.

2. As regards the construction of clock-faces proposed by Mr. Fleming to meet the supposed difficulties, I do not believe that they would ever be adopted or used. If they were exposed in shops, I do not suppose that one would be sold.

3. I do not understand, from the terms of the Toronto Memorial, what steps the memorialists wish the Government to take, except "perhaps to direct the attention of official and scientific authorities in "Great Britain, and of Foreign Governments, to it." I do not imagine that Her Majesty's Government are inclined, *mero motu*, to undertake this responsibility.

4. As far as I can understand the usual policy of the British Government in social matters, it has been, to adopt the general sense of the nation in the broad features of any such arrangements, and to give to them that accuracy and uniformity which only a Government can give. Among other matters, I am officially cognizant of the laws and regulations respecting standards of length, weight and capacity, and I believe that the system secured by the policy which I mention is most excellent. The same may be said in regard to Bills of Exchange, Cheques, &c., where rules, suggested by usage, have been adopted and legalized by the Government.

5. I would suggest for consideration, that an answer be given nearly of the following tenor: That Her Majesty's Government, recognizing in some degree the inconveniences described by the memorialists, are not able at present to compare with them the possible inconvenience which might arise from the interference of Government in such a matter. That it has been the custom of Her Majesty's Government to abstain from interfering to introduce novelties in any question of social usage, until the spontaneous rise of such novelties has become so extensive as to make it desirable that regulations should be sanctioned by superior authority. That it does not appear that such extensive spontaneous call in reference to the subjects of the Memorial, has yet arisen. That it appears desirable that the question should be extensively ventilated by the memorialists, and should be submitted by them to the principal Geographical and Hydrographical bodies, including (perhaps with others) the Royal Geographical Society, and the Dock Trustees or other commercial bodies, at London, Liverpool and Glasgow.

I have, &c.,

G. B. AIRY.

The Right Hon. The Secretary of State for the Colonies, &c.

PROFESSOR PIAZZI SMYTH, ASTRONOMER ROYAL FOR SCOTLAND, TO THE COLONIAL OFFICE, LONDON.

ROYAL OBSERVATORY, EDINBURGH, Aug. 30, 1879.

SIR,—I have the honour to acknowledge the receipt of your letter of "Augnst" 30, 1879, transmitting to me copies of a Canadian pamphlet on "Time Reckoning and the selection of a common Meridian," and intimating that Sir Michael Hicks-Beach will be so obliging as to transmit to Canada, through the Governor-General of the Dominion, any observations which I may have to make on the subject. I gladly accept Sir Michael Hicks Beach's obliging offer, and will speedily send a letter for such desirable transmission.

I am, &c., &c.,

PIAZZI SMYTH,

Astronomer-Royal for Scotland.

To Edward Wingfield, Esq., Colonial Office, Whitehall, London.

PROFESSOR PIAZZI SMYTH, ASTRONOMER ROYAL FOR SCOTLAND, TO THE COLONIAL OFFICE, LONDON.

ROYAL OBSERVATORY, EDINBURGH, Sept. 5th, 2879.

SIR,—In further answer to your letter of "August" I have now the pleasure of sending you my remarks on the Time-reckoning Pamphlet transmitted by the Governor-General of the Dominion, and request you to be so good as to present them to Sir Michael Hicks Beach for his obliging promise to be so good as to forward them to the Secretary of the Canadian Institute through the Governor-General of the Dominion.

I am, &c. &c.,

PIAZZI SMYTH,

Astronomer-Royal for Scotland.

To Edward Wingfield, Esq, Colonial Office, Downing Street, London.

ROYAL OBSERVATORY, EDINBURGH, Sept. 5th, 1879.

Remarks on Mr. Sandford Fleming's papers on Time Reckoning and the selection of a Prime Meridian :—

These papers, transmitted now through the Governor-General of the Dominion, are before me for the second time; for they were sent first for an opinion, to be addressed to their author, many months ago by a mutual friend in Halifax, Nova Scotia. I praised them then for their good intentions on a matter of daily-growing importance to mankind, but condemned them for the want of practicality and the unadvisableness of the particular method proposed to be employed; and my opinion is still very much the same.

No matter what beautifully-written schemes any few very learned men may propose in their closets, the world at large, who gain their daily bread by toil of some kind or another, will insist on having, observing, or arranging their working days mainly according to the Sun, in their own locality or Meridian. Local time will never therefore be dispensed with amongst mankind at large. And when, for the convenience chiefly of the travelling portion of the community, the local time of one has to be compared with the local time of many other places, and can be accomplished most easily by one of them being considered superior to, and made the Prime of, the others, the Meridian locality of the greatest number of mankind is certain to be most regarded, and will assuredly prevail, and become the chief of all, as any opinion of a majority invariably in the end overcomes that of a minority. Yet Mr. S. F's proposed Prime Meridian for all mankind is in a part of the world where there are either no inhabitants at all, or, if a few do reside near one end of the line, they are a miserable driblet of wretched Kamschatkan savages, prowling with difficulty for food over snowy wildernesses under the doubtful rule of Russia !

Mr. Sandford Fleming seems to know perfectly well that in making such a proposition he is running full tilt against common sense and universal experience. But then he urges the plea of national jealousies being aroused if the Prime Meridian were to pass through the country of one powerful European nation more conveniently for its inhabitants than for those of another ; so he does them all equally a mischief by making his Meridian convenient to no one ; and proudly holds that the grand object now of advanced civilization is to consult in everything the utmost development of inter-nationality, or the breaking down of all the ancient bounds which have hitherto divided one nation from another, and in fact formed them into nations.

But, pray, who originally made the nations, God or Satan ? Really one would almost think the latter, when certain modern politicians are so perpetually urging upon their countrymen the propriety, nay the very virtue of their doing all they can to destroy those primeval distinctions, and remove them from the face of the earth.

Yet the Bible, which in this country we all profess to believe, tells us in language perfectly unmistakable, that the nations were a directly Divine institution, enacted by God himself ; wherefore, woe indeed to whoever attempts to abolish their distinctions. Some men, no doubt, have tried, but then who, and what manner of persons were they ?

Chiefly members of the dread International Commune which transcends all mere radical politicians in seeking even by blood and fire to destroy most completely the nations, and to form all mankind into one vast, headless society. And that said Commune is utterly atheistic, without any notion of a God.

Just as its parent predecessor, the first French Revolution, after killing off France's Royal Family invited others to do the same while they publicly proclaimed there was no God, declared the Bible to be only an invention of the priests, and claimed the whole earth as the possession of Communistic man, without any superior over him for evermore. But whatever other nations may choose to do, the bulk of the British nation, because it believes the Bible to be the inspired word of God, and obeys Bible teaching, will never be guilty of anything after that Communistic sort, and will never seek to destroy either its Royal Family or its national weights and measures divinely given to the *origines* of its race as an historic heir-loom in the mysterious beginning of time, and in antiquity vastly more remote as well as sublime than any of the names quoted by Mr. Sandford Fleming.

Hence the British nation will be under no perplexity on this abstract subject of time-keeping, though some of its requirements do crop up more and more conspicuously as the world grows older, and the fulness of the Gentiles begins to come in. For, if the nation does really desire to continue to run in the national paths prepared for it by God, and as they may be read off now with increasing distinctness in the sure word of prophecy, it has only to consider what Prime Meridian will best suit its own people, wherever they congregate in the greatest numbers. And it has something of that kind to consider and legislate for at the present moment, as thus:

On the very same principle that for two centuries past, the British have held their Prime Meridian to be that which passes through England, London, Greenwich; so now in this present age, when the hundreds of millions of living souls of India have been given us by Providence for fellow-subjects, the Prime Meridian of the whole nation should, in fairness and justice, be removed from Greenwich, not westward, but eastward. And if the question be next raised, "how far," then due regard to numbers, climate and geographical aptitudes for British life, manufactures and commerce as over-ruled and directed by the only true religion, bring us to the general Meridian of Egypt. And in Egypt more particularly and precisely to the exact Meridian line of that both *ante* and *anti* Egyptian Monument alluded to by Isaiah, viz., the great Pyramid. For that is the pillar "matzaybah," announced by the Messianic Prophet as destined to come forth in the latter day as a sign and a witness to the Lord of Hosts; and it is now found by scientific examination, and weights and measures, proof to contain, conformably with the Bible, religious and prophetic testimony of its own, from before the beginning of any of the nations, to the glorious future of the Anglo-Saxon people, American as well as British. But only for just so long as they obey God in the national paths and within the national bounds which He, with omniscient knowledge of the future through

all its "times and seasons," appointed to them of old, for purposes of His own, in the government of this world, now comparatively near establishment, according to all the more chronological of the Prophets both of the Old and New Testaments.

PIAZZI SMYTH,
Astronomer Royal for Scotland.

THE LORDS COMMISSIONERS OF THE ADMIRALTY TO THE SECRETARY OF STATE FOR THE COLONIES.

ADMIRALTY, 4th October, 1879.

SIR,—With reference to your letter of the 28th of August, covering a Pamphlet advocating the establishment of a Prime Meridian, that should be common to all nations, I am commanded by my Lords Commissioners of the Admiralty to acquaint you, for the information of the Secretary of State for the Colonies, that it does not appear to their Lordships that there is a sufficient demand by the public to justify Her Majesty's Government in attempting to change the existing practice, and that before seriously considering the question, they would be glad to learn that it had been more extensively discussed among the geographical and nautical bodies who are more interested in it.

I am, &c.,
ROBERT HALL.

The Under-Secretary of State, Colonial Office.

SIR M. E. HICKS-BEACH, COLONIAL SECRETARY, LONDON, TO THE MARQUIS OF LORNE, GOVERNOR-GENERAL, CANADA.

(Canada, No. 367.) DOWNING STREET, 13th November, 1879.

MY LORD,—With reference to my despatch No. 343, of the 17th ultimo, enclosing copies of letters received from the Admiralty and certain scientific bodies respecting the pamphlet entitled "Time-Reckoning and the establishment of a Prime Meridian," I have the honour to transmit to you a copy of a further communication on the subject from the Royal Society.

I request that this paper may be forwarded for the information of the Institute at Toronto.

I have, &c.,
M. E. HICKS-BEACH.

GOVERNOR-GENERAL,
The Right Hon. the Marquis of Lorne, K.T., G.C.M.G.

THE SECRETARY OF THE ROYAL SOCIETY, LONDON, TO THE COLONIAL OFFICE.

THE ROYAL SOCIETY, BURLINGTON HOUSE, November 6th, 1879.

SIR,—In reply to your letter dated 28th August, 1879, enclosing copy of a letter from the Secretary of the Canadian Institute, Toronto, with copies of a pamphlet relative to the establishment of a Prime Meridian that shall be common to all nations, I am directed to offer the following observations :—

The President and Council of the Royal Society have taken into consideration the proposals of Mr. Sandford Fleming relative to Time-reckoning and to the establishment of a Prime Meridian, which were forwarded by the Council of the Canadian Institute, with a Memorial, to His Excellency the Governor-General of Canada.

The proposal consists of two parts—(1) The establishment of a system of Cosmopolitan Time, with plans for the ready passage from this to approximate local Time. (2) The choice of a Prime Meridian which should be common to all nations.

The convenience of a system of Time-reckoning which should be common to all the earth is easily seen; while at the same time it is obvious that if such a reckoning be at all generally used, there must be means of readily passing from it to local Time, or at least approximate local Time, which is intimately bound up with the daily business of life.

The means recommended by the author are simple and seem well devised. The difficulty is, of course, to induce the different civilized nations of the world to concur in this or any similar scheme.

With regard to the second point, the establishment of a Prime Meridian common to all nations, the author has adduced strong reasons, founded on convenience, why a Meridian passing through Behring Strait, or nearly so, should be chosen. It happens that a Meridian 180° from that of Greenwich fulfils the condition, and if this were adopted, the change in existing maps, &c., which refer to the Meridian of Greenwich as the Prime Meridian, would not be very serious. The choice, however, of a Prime Meridian, even to the extent of adopting one exactly 180° from a Meridian at present in use as a Prime Meridian, is one upon which the susceptibilities of individual nations might make it more difficult to obtain concurrence than upon the mere adoption of a common system of cosmopolitan Time-reckoning in the abstract.

While disposed to look favourably on the proposed scheme, the President and Council feel that no scheme of the kind would have much chance of success unless there were a general readiness on the part of civilized nations seriously to entertain the question.

I have, &c.,

G. G. STOKES, Secretary R. S.

To Edward Wingfield, Esq., Asst. Under-Sec. of State for the Colonies.

MEMORANDUM BY DR. DANIEL WILSON, PRESIDENT OF THE CANADIAN INSTITUTE, FOR TRANSMISSION WITH THE SECOND ISSUE OF MR. SANDFORD FLEMING'S PAPERS, BY HIS EXCELLENCY THE GOVERNOR-GENERAL TO THE IMPERIAL GOVERNMENT, APRIL 5TH, 1880.

Although the subject discussed in the accompanying papers has not hitherto attracted general attention, it has to some extent met with consideration in various quarters, and it is probable that at no distant day public interest will be awakened to its importance.

Uniform time has long been employed for scientific purposes; it has been used in recording simultaneous magnetic observations, in geographical and astronomical calculations, in observing the movement of tides, the track of meteors, the waves of earthquakes, and in systematically recording meteorological phenomena.

It is only of late years that the rapidity of communications by Railway, and the facilities afforded by the Telegraph, have created new conditions which suggest and seem to demand some general system of uniformity in reckoning Time in the ordinary occupations of life.

Those whose avocations bring them in contact with the inconveniences and complications which arise from our present notation, feel that the necessity of some improvement will before long become absolute.

The question is recognized to be cosmopolitan in its character; and although everywhere the difficulty may in some degree be felt, it is on the American Continent, in Canada and the United States, that it is rapidly gaining marked prominence.

A large amount of capital has been expended by the Dominion of Canada in the establishment of railways and telegraph lines, and the Government is now appropriating one hundred millions of dollars towards their construction to the Pacific Ocean.

In a few years the railways proposed will be completed, and they will extend over 75 degrees of longitude. The various clocks in the intervening distances, by which the lines will be operated, and the ordinary business of daily life carried on, will, under the present system of reckoning Time, differ from point to point, until the maximum difference of about five hours is reached. Accordingly the geographical extent of territory, and the general advancement of the Dominion of Canada, point to the necessity, at no remote period, of seeking for some change in the present system of reckoning Time.

The territory of the United States of America extends from Eastport in Maine to the western confines of Alaska, localities differing in longitude 100 degrees; in time, 6 hours and 40 minutes. Between

Maine and the Pacific States of Washington, Oregon and California, the difference in time is nearly 4 hours. The railway system is developing in a marvellous manner in the United States; the population is ten times that of Canada. If, therefore, the question of Time-reckoning claims attention in the Dominion, the necessity of its earnest consideration in the United States is still more manifest.

The American Metrological Society has had the subject under consideration. A careful report has been prepared, setting forth the necessity for change, and advocating uniformity and accuracy in the system of time-reckoning. From this report it appears that there are no less than seventy-five distinct local time Standards used by the Railways of the country, all differing the one from the other, the greatest difference reaching 3 hours and 58 minutes. The most prominent Railway managers have been consulted, and with the exception of a small minority, they have placed on record the opinion that "a uniform Time" would not only be a great convenience to the public and to the Railway employees, but would materially lessen the risk of accidents. It is accordingly strongly recommended that some means be taken to establish an absolute uniformity of Time throughout North America.

Mr. Sandford Fleming, by whom the Intercolonial Railway of Canada was constructed, and who is now Engineer-in-Chief of the railway in process of construction to the Pacific, has had his attention directed to the inconveniences, confusion, and complications in Time-reckoning which are threatened by the rapid extension of the railway works under his charge, and he has suggested a practical solution of the difficulties which he foresees.

The question is likewise of general scientific interest; and its solution is of value far beyond Canada, for it involves a question in which all civilized peoples are concerned. If uniformity be desirable in Canada and the United States, may it not be equally important to employ it throughout the whole world? Does it not therefore become desirable to seek the co-operation of men of science in other countries, and, if possible, gain general concurrence in any scheme which may be proposed?

At the instance of His Excellency the Governor-General of Canada, the subject was brought under the notice of the Royal Society of England. That distinguished scientific body has recently forwarded a communication to His Excellency, of which the following is an extract:—

"The President and Council of the Royal Society have taken into "consideration the proposals of Mr. Sandford Fleming, relative to "Time-reckoning and to the establishment of a Prime Meridian, "which were forwarded by the Council of the Canadian Institute, "with a memorial to His Excellency the Governor-General of "Canada.

"The proposal consists of two parts. (1) The establishment of a "system of Cosmopolitan Time, with plans for the ready passage "from this to approximate local Time. (2) The choice of a Prime "Meridian which should be common to all nations.

"The convenience of a system of Time-reckoning, which should be "common to all the earth, is easily seen, while at the same time it is "obvious that if such a reckoning be at all generally used, there must "be means of readily passing from it to local Time, or at least "approximate local Time, which is intimately bound up with the "daily business of life. The means recommended by the author are "simple and seem well devised. The difficulty is of course to induce "the different civilized nations of the world to concur in this, or any "similar scheme.

"With regard to the second point, the establishment of a Prime "Meridian, common to all nations, the author has adduced strong "reasons, founded on convenience, why a Meridian passing through "Behring Strait, or nearly so, should be chosen. It happens that a "Meridian 180° from that of Greenwich fulfils this condition, and if "this were adopted, the change in existing maps, etc., which refer to "the Meridian of Greenwich as the Prime Meridian, would not be "very serious.

"The choice, however, of a Prime Meridian, even to the extent of "adopting one exactly 180° from a Meridian at present in use, as a "Prime Meridian, is one upon which the susceptibilities of individual "nations might make it more difficult to obtain concurrence, than "upon the mere adoption of a common system of cosmopolitan time "reckoning in the abstract.

"While disposed to look favourably on the proposed scheme, the "President and Council feel that no scheme of the kind would have "much chance of success, unless there were a general readiness on "the part of civilized nations seriously to entertain the question."

Thus the report of the Royal Society recognizes the advantages derivable from a system of Cosmopolitan Time as an abstract proposition. The Metrological Society (New York) points out the positive urgency of reform in the United States, advocates that the use of local time be discontinued, and strongly recommends the adoption of a uniform Standard throughout the country. In Canada, as in the United States, the question has become one of practical economy. Even now the necessity for some more convenient system of reckoning Time is experienced, and on the completion of the railway to the Pacific Coast, the necessity will become absolute. It is, therefore, not only in the interest of North America, but as a question involving practical results of value to every civilized nation, that savants of other countries may be consulted with the view of maturing a scheme in every respect acceptable.

In pursuance of the suggestion implied in the report of the President and Council of the Royal Society, it appears advisable that an effort be made to ascertain how far the scheme would obtain general concurrence.

The establishment of Cosmopolitan Time involves the primary determination of an initial Meridian, as a zero for computing the revolutions of the globe on its axis; and it is only by common consent that such Prime Meridian can be determined.

Mr. Sandford Fleming advocates the selection of a Prime Meridian, common to all nations, from the fact that its establishment is really the key to any scheme of Time-reckoning, of universal application. He has submitted his views free from all local bias, and has aimed at the selection of an initial Meridian and Time-zero which, while awakening no national susceptibilities, would be generally acceptable to all civilized people.

It is earnestly hoped that this attempt to deal with an acknowledged impediment, alike to International scientific operations, and to the rapidly extending relations of trade and commerce, will be considered in a liberal spirit; and that civilized nations may be found not unwilling to concur in a proposal which offers a ready means of bringing into use some scientific system of reckoning Time such as the age seems to demand.

DANIEL WILSON, LL. D., F. R. S. E.,
President Canadian Institute.

TORONTO, April 5th, 1880.

NOTE FROM HIS EXCELLENCY THE GOVERNOR-GENERAL OF CANADA, TRANSMITTING MR. SANDFORD FLEMING'S PAPERS TOGETHER WITH THE REPORT OF THE AMERICAN METROLOGICAL SOCIETY, TO VARIOUS SCIENTIFIC SOCIETIES IN EUROPE.

GOVERNMENT HOUSE, OTTAWA, CANADA, May 12th, 1880.

The subject of a Prime Meridian common to all nations in connection with Time-reckoning having been brought to the notice of the Governor-General of Canada by a memorial from the Canadian Institute, the accompanying papers by Mr. Sandford Fleming are forwarded with His Excellency's compliments, together with a report of the American Metrological Society on the same subjects.

The Governor-General of Canada would be glad of any expression of opinion as to concurrence with the views therein stated which your

Society might desire to be conveyed to the Canadian Institute, under whose authority these papers have been published.

SOCIETIES IN EUROPE.

1.	The Institut de France	Paris.
2.	Société de Géographie	Paris.
3.	Société Belge de Géographie	Brussels.
4.	Königliché de Preussische Akademie der Wissenchaften	Berlin.
5.	Gesellschaft für Erdkunde	Berlin.
6.	Kaiserliche Akademie der Wissenchaften	Vienna.
7.	K. K. Geographische Gesellschaft	Vienna.
8.	Nicolaevskaia Glavania Observatoria	Pulkova.
9.	Imper. Rousskae Geograficheskoe Obschestov	St. Petersburg.
10.	Imper. Akademia Nauk	St. Petersburg.
11.	Société de Géographie	Geneva.

THE SECRETARY OF THE IMPERIAL ACADEMY OF SCIENCES, ST. PETERSBURG, TO THE GOVERNOR-GENERAL, CANADA.

St. Petersbourg, le 10 Novembre, 29 Octobre, 1880.

Monsieur,—L'Académie Impériale des Sciences, ayant reçu, de votre part, les deux écrits de M. Sandford Fleming et Cleveland Abbe, sur l'adoption d'un Temps Universel et sur le choix, à cet effet, d'un Premier Méridien, a chargé M. Struve, Directeur de l'Observatoire Astronomique de Poulkova, d'examiner cette question.

Après avoir pris connaissance de ces ouvrages, M. Struve en a fait l'object d'un rapport qui était présenté à l'Académie dans sa séance du 14–26 octobre, 1880.

Conformément à la décision de l'Académie, j'ai l'honneur de vous transmettre ci-joints le rapport de M. Struve, ainsi que les deux exemplaires d'un discours en langue russe fait par lui en 1870, à la Société Géographique de St. Pétersbourg sur la même question.

Veuillez agréer, Monsieur, l'assurance de ma considération la plus distinguée.

C. VESSELOFSKY,

Sécretaire Perpétuel.

A Monsieur le Gouverneur-Général du Canada.

(TRANSLATION)

REPORT ON UNIVERSAL TIME AND ON THE CHOICE FOR THAT PURPOSE OF A PRIME MERIDIAN; MADE TO THE IMPERIAL ACADEMY OF SCIENCES, ST. PETERSBURG, BY M. OTTO STRUVE, MEMBER OF THE ACADEMY AND DIRECTOR OF THE OBSERVATORY AT PULKOVA.

[Read 30th September, 1880.]

The two papers (Sandford Fleming, "Time-Reckoning and the selection of a Prime Meridian," and Cleveland Abbe, "Standard Time, Report to the American Metrological Society,") sent to the Academy by order of the English Government, owe their origin to the great necessity felt in the United States and in the English possessions in North America for introducing into some branches of the public service, namely, the railway and telegraph departments, an uniform and rational system of time-reckoning. In the report of Mr. Abbe the problem is considered principally from a local point of view. He sets forth the motives that have engaged the American Metrological Society to adopt a series of resolutions with the view of lessening the defects in the system at present in use in the United States, a system which has been introduced, little by little, so to speak, without recognizing the wants of the traveller or the management of railways. There is, in this paper, but one resolution of a more extended range, that of recommending to the Government and the public, the exclusive use in the United States, of Time corresponding with the Meridian situated six hours to the west of Greenwich. The Metrological Society admits in principle the desirability in the future that an uniform Time should be introduced over all the globe, and it pronounces itself in favour of the Time reckoned from the Meridian, situated 180° from that of Greenwich.

The memoir by Mr. Fleming, supported in his conclusions by the Canadian Institute of Toronto, is of a more general character. It proposes directly the adoption of the Meridian, situated at 180° from Greenwich, as Prime Meridian for the whole globe, and the introduction of a Standard Time, reckoned from this Meridian, for the use of science and for certain purposes for use also in every-day life. This Time might be called Cosmopolitan Time to distinguish it from local Time, and his memoir presents different propositions in view of facilitating its general introduction. Nevertheless the arguments in favour of its universal introduction are merely stated in the said memoir as suggestions which may attract the attention of the world on this important question and lead to ulterior discussions. For the moment the author of this paper desires only to get from competent au-

thorities of different countries a response to the two following questions :—

1st. Does the Time zero, or Prime Meridian, proposed in the memoir, appear suitable and of a nature to be adopted by all civilized nations?

2nd. If the Prime Meridian proposed give rise to serious objections, would there be any other Meridian better qualified, and which would have more chance of being adopted by all the world?

Particular circumstances have singularly enabled the writer of this report to offer an answer to the first of these questions. Nearly ten years ago, at the desire of our illustrious President, the question of a Prime Meridian was made my special study; the results of which were given in a discourse, delivered on the 4th February, 1870, at the Geographical Society of Russia. On this occasion I discussed the question solely from a geographical point of view, specially considering the interests of hydrography and navigation.

On this point the simplest solution seemed to me to adopt as Prime Meridian that of Greenwich, which in this case would unite the majority of voices. The preference given to this Meridian was based, on one side, on the historical right of the Royal Observatory of England, acquired by eminent services rendered by this establishment during the course of two centuries to mathematical geography and navigation, on the other hand, considering that the great majority of charts now in use upon all the seas are made according to this Meridian, and about 90 per cent. of the navigators of long-standing are accustomed to take their longitudes from this Meridian. However, an objection against this proposition is that the Meridian of Greenwich passes through two countries of Europe, and thus the longitudes would be reckoned by different signs in different portions of our own continent, and also of Africa. Moreover, the close proximity of the Meridian of Paris, to which, perhaps, some French geographers and navigators of other nations would still hold, from custom, from a spirit of contradiction or from national rivalry, and which might easily cause sad disasters. To obviate these inconveniences I have proposed to choose as Prime Meridian another Meridian situated at an integral number of hours east or west of Greenwich, and among the Meridians meeting this condition I have indicated in the first place the Meridian proposed to-day by scientific Americans as that which would combine the most favourable conditions for its adoption.

Thus the Meridian, situated 180° from Greenwich, presents the following advantages :—

1. It does not cross any continent but the eastern extremity of the North of Asia, inhabited by people very few in number, and little civilized, called Tschouktschies.

2. It coincides exactly with that, where, after the custom introduced by an historical succession of maritime discoveries, the navigator makes a change of one unit in the date; a difference which is made near a number of small islands in the Pacific Ocean, discovered during the voyages made to the east and west. Thus the commencement of a new date would be identical with that of the hours of Cosmopolitan time.
3. It makes no change to the great majority of navigators and hydrographers except the very simple addition of 12 hours, or of 180° to all longitudes.
4. It does not involve any change in the calculations of the ephemerides most in use among navigators, viz., the English Nautical Almanac, except turning mid-day into midnight, and *vice versa*. In the American Nautical Almanac there would be no other change to introduce. With a cosmopolitan spirit, and in the just appreciation of a general want, the excellent ephemerides, published at Washington, record all data useful to navigators, calculated from the Meridian of Greenwich.

For universal adoption, as proposed by the Canadian Institute, it recommends itself to the inhabitants of all civilized countries, by reason of the great difference in longitude, thus removing all the misunderstandings and uncertainties concerning the question as to whether in any case Cosmopolitan or Local Time was used.

In answer to the first question offered by the Institute at Toronto, I would therefore recommend the Academy to pronounce without hesitation in favour of the universal adoption of the meridian situated 180° from Greenwich as Prime Meridian of the globe.

Accepting this conclusion, the second question brought by the Canadian Institute has no further interest to us.

It remains for me to say a few words on other questions presented in the memoir of Mr. Fleming. He offers suggestions on several points which awaken a desire for further investigation. These suggestions seem very wise. The ideas concerning the introduction of a common Time in all countries probably will yet take time to ripen, and some propositions set forth by Mr. Fleming will meet perhaps with insurmountable difficulties in the habits and interests of several countries. To my mind, the most serious obstacle consists in the fact that there is no means of indicating Cosmopolitan Time in different parts of the world, while the rising and setting of the sun are the phenomena which, we know, regulate the every-day occupations of human life. But the question presents itself in another way, when it affects only the sciences. Without doubt in some sciences, for example, astronomy, meteorology, physical geography, and generally in all questions requiring an exact determination of time,

the adoption universally of one Time would be a valuable advantage and might be easily effected. It would save much time and remove a number of difficulties. We must, however, own that in other scientific questions the usage of a local time in reference to the rising and setting of the sun would be preferable. For the present it would be well to consider at what point the introduction of Cosmopolitan Time in the sciences would be opportune.

The universal acceptance of another idea set forth by Mr. Fleming would probably meet with few obstacles, and its general introduction is recommended. In the opening pages of his memoir he makes the following remarks :—

> "The division of the day into two halves, each containing 12 "hours, is a fertile source of error and inconvenience. This "division has been long in use, but apart from its antiquity "there is nothing to recommend it, and its use does not confer "any benefit to man."

Permit me to say that I partake entirely of his views. For this reason I wish particularly to draw the attention of the Academy to them.

The division of the day into two halves seems to have slipped into common use without any sufficient reason. In consequence of the inconveniences it causes it is desirable that it should be replaced by the simple division of the day into 24 hours. The example of the Italians and some other nations, where this simple division is adhered to until this century, proves that its general adoption would not meet with serious difficulties.

To my idea the Academy would render a great service to the world if it supported this proposed change.

In conclusion, I take the liberty of sending, on the part of the Academy, two Russian papers read at the Geographical Society of Russia in 1870, which might be of interest to the Canadian Institute at Toronto, and to the American Meteorological Society at Washington.

OTTO STRUVE.

30 September, 1880.

REMARKS ON A UNIVERSAL PRIME MERIDIAN, BY DON JUAN PASTORIN, LIEUT.-COMMANDER OF THE SPANISH NAVY.

Transmitted by the British Minister at Madrid through the Colonial Office by despatch, 13th March, 1882, to His Excellency the Governor-General. The communication is in the form of a preface to a translation and re-publication in the Spanish language, at the office of "Revista-General de Marina," of the several papers on Time-reckoning and a common Prime Meridian, published by the Canadian Institute (Toronto).

(TRANSLATION.)

It has always seemed to me very lamentable that there should exist such a multiplicity of Meridians, and, while in the classes of the Naval College I could not understand why the unscientific plurality of our reckonings of longitude, condemned openly by both the Professors and the books we studied, should be persisted in. Spain has counted the longitude from the Meridian of the Straits of Gibraltar, Toledo, the ancient College of Marine Guardo de Cadiz, San Fernando (in two different citations those of the two observatories, the ancient one and the present one), Ferrol, Cartagena, Plaza Mayor of Madrid, observatory of the same capital, Coimbra, Lisbon (in three distinct places corresponding to the successive observatories), the Cathedral of Manilla, the Island of Hierro (in different points, some doubtful)—and, to-day, it is proposed heedlessly to give another Meridian of reference.

The marine authorities of the most advanced countries of the world count the time by Greenwich, Paris, San Fernando, Naples, Christiania, Island of Hierro, Pulkova, Stockholm, Lisbon, Copenhagen, Rio de Janeiro; and I do not cite Washington because the authorities of the great Republic of North America, setting aside small ideas and national jealousy, use for the purposes of navigation the time of Greenwich.

It is therefore a natural consequence that the geographer in examining different charts and in reducing one Meridian to another, finds himself surrounded with difficulties, and in some cases impossibilities, for the reduction is impracticable on maps not arranged upon the Mercator projection.

Why should there be this intolerable multiplicity?

Several times it has been attempted to do away with it, but without success. In 1869, Spain appointed a Commission to propose rules respecting our maps and charts; but notwithstanding the competency of the individuals who composed it,* the Commission ceased its labours without even giving a reason why nothing had been done.

International Congresses have met in Antwerp and in Paris, but have not come to any decision respecting geographical maps; nor are

* The Commission was composed of José Emilio de Santos, Francisco de Paula Marquez, Francisco Chacon y Orta, Antonio Aquilary Vela, Carlos Ibanez, Eduardo Benot and José Morer.

there any signs of any attention being paid to the resolution adopted in Antwerp, where it was agreed that in maritime charts the Meridian of Greenwich should be used. Custom so enslaves common sense that we admit as natural, things which are most ridiculous, and we are not even prompted to smile at the absurdity. Thus here in Madrid we receive telegraphic despatches from the Philipine Islands hours, and sometimes even the day previous to that on which the events referred to therein have taken place. The same happens in England respecting the despatches from Australia. I remember an example in point; at three in the morning of the 1st October, 1880, they received in London the news of the opening of the Universal Exhibition at Melbourne at one o'clock in the afternoon of that day.

What argument is advanced for the continuation of a state of things which becomes more and more indefensible?

I confess I have never seen one plausible reason given for the present system.

Antiquity is the claim made by those who favor the Meridian of Teneriffe and Hierro.

The security of direct observation is the boast of the partisans of each Meridian held by their particular observatory.

The division of the continents into two hemispheres is advocated by those whose sympathies are with the same Meridian of Hierro, or with the Meridians contiguous to Behring Strait, as the initial circle would result in being anti-meridians of Greenwich, Christiania, Naples and Paris.

The great Laplace has said: "It is desirable that all the nations of Europe, in place of arranging geographical longitude from their own observatories, should agree to compute it from the same Meridian, one indicated by nature herself, in order to determine it for all time to come. Such an arrangement would introduce into the science of geography the same uniformity which is already enjoyed in the calendar and the arithmetic, and, extended to the numerous objects of their mutual relations, would make of the diverse peoples one family only."

The disadvantages and confusion resulting from the multiplicity of the zeros of longitude, are so great that the whole world ought to proclaim the necessity of one universal Meridian, but still there are those who do not seem to recognize it. There are others who oppose the adoption of an international Meridian on the ground of the difficulty of determining with absolute precision the difference of longitude between two places, although situated on the same continent, and in support of their arguments they cite the discrepancies in the results of modern observatories as compared with ancient ones, although the former are made from observatories so favourably situated as those of Paris, Greenwich, Washington, &c.

Not being satisfied with the arguments against a universal Meridian, it can be imagined my surprise when it came to my knowledge that a body of men so distinguished and competent as the Geographical Society of Madrid had recommended another Meridian passing by the Punta de la Orchilla, the extreme western end of the Island of Hierro. One more Meridian, when there were so many already!

Desirous of understanding the reasons which prompted the Society to adopt such a resolution, I solicited the honour of being allowed to enter into the subject. This was conceded to me, and while it was occupying my mind I came into possession of the very valuable documents given to the light by the Canadian Institute, and which are the offspring of the clear intelligence of one of its most distinguished members, Mr. Sandford Fleming.

So thoroughly was I convinced by the arguments of this eminent engineer, and so very practical did his system seem for the creation of a uniform Time-reckoning for the whole world, that I resolved to translate his valuable paper into our language, with the view of founding upon it a proposition which I should ere this have presented to the Geographical Society had not my time been wholly taken up by a Special Commission entrusted to me by His Excellency the Minister of Marine, Don Santiago, Duran of Lira, in connexion with the constant differences which take place between our fishermen and those of Portugal on our southern coasts.

The work which follows this preface is not, strictly speaking, a literal translation of the paper of the distinguished member of the Canadian Institute, but I believe, nevertheless, that I have most faithfully interpreted the thoughts of the wise academician, and also faithfully presented the essential passages of his work. If I have not done so, it has not been the fault of my good will.

Will the ideas of the author ever be adopted and put into practice? For my part, I think they will. The present system is indefensible, and it is only necessary to study the new method without prejudice, and think over the means proposed, to see their clearness.

Will there be found people to find fault with the system?

Undoubtedly! The electric telegraph was considered an impossibility half a century ago, and, to-day, the wires of this impossibility encircle our globe.

JUAN PASTORIN.

Ayamonte, 30th April, 1881.

THE GEOGRAPHICAL SOCIETY OF BERLIN, 1881.

*Remarks upon a Normal Time to be common to the whole earth, and a Prime Meridian, to be accepted by all nations, by Dr. G. V. Boguslawski.**

(TRANSLATION.)

During the last decade, the gigantic development of railway and telegraph communication in the United States and the British possessions of North America, has in a marked manner caused the necessity to be felt of a common recognized system of Time-reckoning throughout this extensive territory. As a result of this feeling, in the course of this year, two publications have appeared which, with a view to the solution of this problem, submit projects of some force not adaptable to America alone, but which to some extent would be acceptable to the whole world, namely: Cleveland Abbe, "Report on Standard Time to the American Metrological Society," and Sandford Fleming, "Papers on Time-Reckoning and the selection of a Prime Meridian to be common to all nations."

The Director of the Observatory at Pulkova, member of the Academy of Science, St. Petersburg, and our honorary member, Herr Otto Struve, in accordance with a commission of this Academy in the meeting of September, 1880, has presented a report on both these papers, and on the propositions which they contain for the solution of the general question of a normal Time-reckoning and of a universally observed first meridian, which, in connection with other remarks on the same question, we will allude to.

The report of Mr. Cleveland Abbe chiefly examines the problem from a local point of view. He sets forth the motives which have prevailed with the American Metrological Society, to accept a series of resolutions which, from the imperfections in the present system followed in the United States of America, have in view the removal of the inconveniences proceeding from present practice of Time-reckoning, a practice which, so to say by degrees and incidentally, has come into force, without taking any account of the necessities of the travelling public and the management of railways. One resolution only in the dissertation of Cleveland Abbe, is of a more wide-bearing significance, viz., that which recommends to the government and to the public within the United States to refer the Time exclusively to a meridian 6 hours or 90° west of Greenwich. The Metrological Society thus accepts the principle that it is desirable that in the future a uniform central Time be introduced for the whole earth, and by this opportunity expresses itself in favour of the meridian 180° from Greenwich as the first meridian.

* Verhandlungen der Gesellschaft für Erdkunde, zu Berlin. Herausgegeben im Auftrage des Vorstandes von Dr. G. V. Boguslawski. Band VIII., No. 6 u. 7. Zeitungen von 9 Juni und 2 Juli, 1881, Berlin.

The dissertation of Mr. Sandford Fleming is of a more extended (*allgemeineren*) character, and his propositions founded upon it, were sustained by the approval of the Canadian Institute, at Toronto, and it is this body, by the intervention of the British Government, which has more widely circulated Fleming's paper. Fleming directly advocates the acceptance of the meridian 180° from Greenwich as the first meredian for the whole earth, and the universal establishment of time reckoned upon this meridian for scientific purposes, and even for many of the relations of every day life. This time we may distinguish as "Cosmopolitan Time," in distinction to local time.

Fleming submits in his treatise different arguments in favour of the universal introduction of this Cosmopolitan Time, indeed mostly in the form of more generally expressed ideas which direct attention to this weighty question, and which can serve as the starting point for a more extended discussion. Above all things, he is desirous of obtaining from competent professional men of all countries, definite answers to the following two questions:

1. Does the Time-zero or Prime Meridian, proposed in the memoir, appear suitable and of a nature to be adopted by all civilized nations?

2. If the Prime Meridian proposed give rise to serious objections would there be any other meridian better qualified, and which would have more chance of being adopted by all the world?

Special circumstances enable Herr Otto Struve to answer the first of these questions, since as early as the 4th February, 1870, before the Geographical Society of St. Petersburg, he discussed the questions in connection with the first meridian, and exclusively from the geographical point of view, with which he specially connected the interests of Cartography (map making and navigation). The simplest solution seemed to him to be to take as a first meridian, that of Greenwich.

Struve sustained this expressed preference on one side by the historical claim of the Observatory of Greenwich which it has established from two centuries of super-eminent service to the cause of mathematical geography and the interests of shipping, and on the other hand from the consideration that the greater part of the present maps in use, especially sea-charts, are projected relatively to this meridian of Greenwich, and that about ninety per cent. of seamen refer their longitudes to this meridian.

But, indeed, according to Otto Struve, there is the circumstance which declares itself against the common establishment of the meridian of Greenwich, as the first meridian, that it passes over three countries of Europe, Great Britain, France and Spain, likewise the continent of Africa, and that accordingly in different parts of Europe and Africa the longitudes would have different descriptions east or west

from Greenwich (or the signs + or —).* The first meridian proposed by Sandford Fleming, 180° from that of Greenwich, according to the present opinion of Otto Struve, offers the following points of pre-eminence :

1. "It passes through no continent excepting the eastern end of North Asia, which is inhabited only by a not numerous and uncivilized tribe, the Tschuktschen.

2. "It closely coincides with that same meridian upon which the seamen, according to custom, must change the date of a day.† The change of a day's date would accordingly coincide with that of the Cosmopolitan Meridian.

3. "It changes nothing in the practice of the majority of seamen and geographers, with the exception of the addition of 12 hours or 180° to all longitudes.

4. "It occasions no change in the calculation of the ephemerides in most general use by seamen, namely, those of the British Nautical Almanac, except the simple transfer of mid-day to mid-night or *vice versa*.

5. "The great differences which would exist between Cosmopolitan and Local Time by the acceptance of this first meridian by the inhabitants of almost all civilized lands would remove all misunderstandings and uncertainties, under different circumstances as to whether Cosmopolitan or Local was intended to be acted upon."

Upon these grounds Herr Otto Struve, of the Academy of Science of St. Petersburg, is willing to recommend for common acceptance the meridian 180° west of Greenwich as the first meridian.

By this opinion the second of Fleming's submitted questions obtains its solution.

With regard to the questions submitted by Mr. Fleming in the general form, as a starting point for further discussion on the introduction for all countries of a common Time-reckoning the Pulkova astronomer remarks, that at present from the various customs and interests of different countries, it must be received with hesitation.

* But it would be easy to remedy this inconvenience, if according to the example of Prof. A. Auwers, in whose praiseworthy contribution to the Geographical Year Book VIII. (1880, pp. 303-310), "Geographical Longitudes and Latitudes of 144 Observatories," all the longitudes from Greenwich are numbered easterly through the full circumference of the circle. Also Prof. C. Bruhns has in his report on Point 33 of the Programme of the Second Meteorological Congress at Rome, 1879, in which he proposes universally to accept the Meridian of Greenwich for Meteorological Maps, laid it down as indispensable, that by the acceptance of any first meridian whatsoever, the longitudes run in one direction only, and indeed be reckoned from the East. The computation in different directions easily leads to misunderstanding and furnishes cause for complications.

† On a ship which, from the East (America), sails to the West (Asia or Australia), and reckons its time according to the mean time of Greenwich, they count from the meridian 180° from Greenwich. If, for example, on 27th July, Greenwich is at mid-night, and then begins the date of the 28th July, it is no more than mid-day on the 27th July, and they must, in order to accord with the Greenwich date, then move forward its date one day from 27th to 28th. Another ship, which sails from the West (Asia or Australia) to the East (America), and equally reckons the time from Greenwich, if Greenwich on the 27th July is at no more than mid-day, upon the meridian 180° from Greenwich it is already mid-night of the 28th July, and they must, in order again to come in accord with the Greenwich date, put back its date a day, thus to count the same date twice over.

The greatest difficulty presents itself in the fact that as yet no means of bringing Cosmopolitan Time into certain relationship with the rise and setting of the sun in the different parts of the earth; the appearance of the sun admittedly governing the ordinary avocations of business life.

But if we consider this question in a scientific spirit, it follows that for some but not for all branches of sciences, for example, for Meteorology and Astronomy and in part also for physical questions of the earth, and in general for all questions which are affected by the close determination of time, the common acceptance of one and the same Time would extend great advantages, and could be effected with little difficulty. Besides, it would save much time, and set aside a great extent of misunderstanding.

According to Struve's view, we must in the first place investigate in what relationship the introduction of Cosmopolitan Time be opportune for science, and for what scientific problems the application of Local Time with its relationship to the rise and setting of the sun can be indicated.

The common acceptance of another proposition of Fleming's, according to Struve, should meet with slight objection, and is to be recommended, viz., to set aside that division of the day into two halves of 12 hours, brought down to us from antiquity, and in its place to establish the simple division of 24 hours, as at present is the case with the Italians;* so indeed that besides the standard datum, exact Standard Time for the several chief places, in the form of 24 Standards one hour apart should be established from which all the remaining Local Times would obtain their derivation.

Our associate, Prof. W. Förster, Director of the Observatory of this place, at the conclusion of his paper, "Review on some Time considerations, especially concerning the establishment of a German Standard Time," read at Hamburg, 7th February, 1881 *(Deutche Revue, 1881, No. 3 and 4)*, has likewise taken into consideration this proposition of the Canadian Institute, and expresses himself against the introduction of 24 chief Local Times for ordinary life, in international relations. On the other hand, he accepts the introduction of a universal and not a national Standard Time in connection with a standard datum for all transactions requiring precision in time. The specified starting-point and time-determination yet to be established, named in the Canadian papers as the "Cosmopolitan," according to Prof. Förster's view, must be the common principle of a universally accepted and undisputed measure of time freed from all differences of local time. Equally for the starting point of Universal Time, he considers the meridian the best suited to be the one exactly 12 hours or 180° from that of Greenwich (thus precisely identical with that of Greenwich). G. V. B.

* Also the day is divided by astronomers into 24 hours.

ADDRESS AT THE INTERNATIONAL GEOGRAPHICAL CONGRESS, VENICE, SEPTEMBER 21st, 1881, ON THE REGULATION OF TIME AND THE ADOPTION OF A PRIME MERIDIAN.

By Sandford Fleming, *Delegate, of the Canadian Institute, Toronto, and the American Metrological Society, New York.*

The subject to which, with your permission, I shall briefly refer, is the establishment of a Prime Meridian and Time-zero, to be common to all nations.

The history of geographical science informs us that a great number of initial meridians have at various times been employed by astronomers and navigators. It is well known that Claudius Ptolemy of Alexandria was among the first to fix a meridian of reference. Ptolemy lived in the second century, when the inhabitable world was thought to be limited to countries around, or not far beyond, the shores of the Mediterranean. From time to time a knowledge of the earth's surface extended, and distinguished geographers arose, who adopted new initial meridians. It is not necessary that I should trouble you with a recital of the list of meridians from which, since the earliest period, longitudes have been reckoned. It is sufficient at this stage to refer to the fact that geographers of different nations have generally selected for starting points places of importance well-known to them, and that, as a rule, they have chosen the capitals or the principal observatories of the nations to which they respectively belonged. Hence the multiplication of meridians of reference throughout the world. Within a comparatively recent period communications between the peoples of different nations have been greatly facilitated, and intercourse has proportionately increased. It has consequently been felt that the variety of first meridians is embarrassing and unnecessary. For a number of years the question of reducing this number has been under consideration; it has been brought before the Geographical Congress at Antwerp, and again at Paris. The question has been examined by different societies, and various proposals have been submitted, but unanimity with respect to the selection of a prime meridian to be common to all nations has in no way been attained. Repeated efforts have been made to gain general concurrence to the adoption of one of the existing national meridians, but these proposals have tended to retard a settlement of the question by awakening national sensibilities, and thus creating a barrier difficult to remove. Other proposals to select an entirely new initial line, unrelated to any one of the first meridians at present recognized, have but little advanced the settlement of the question, as such a course encounters difficulties of another kind, difficulties so serious in their character as to render the proposals almost impracticable.

There are reasons for a unification of first meridians which every year become stronger, and, as the question affects the whole area of

civilization, its consideration should be approached in a broad, liberal spirit. While it may be urged that the selection of any particular meridian is less important than the adoption of a common first meridian, care should be taken to consider the interests of all people concerned, or likely to be concerned, scrupulously avoiding offence to local prejudice or national vanity. On every account it is extremely desirable that an earnest effort should be made to seek for a solution to the problem.

The unifications of initial meridians has been advocated in the interests of geography, astronomy and navigation. I shall accept all the arguments which have been advanced on behalf of these extremely important interests, and crave your indulgence while I submit additional reasons for the establishment of a common prime meridian for all the world.

I propose to direct your attention to arguments which spring from the relations of time and longitude and the rapidly growing necessity in this age for reform in time-reckoning.

If we take into view the whole earth, we have at the same instant in absolute time, noon, mid-night, sun-rise, sun-set, and all intermediate gradations of the day. The telegraph-system, which is gradually spreading like a spider's web over the surface of the globe, is practically bringing this view of the sphere before all civilized communities. It leaves no interval of time between widely separated places proportionate to their distances apart. It brings points remote from one another, enjoying all the different hours of daylight and darkness, into very close contact. Under our present system of notation, confusion is developed, and all count of time is thrown into disorder.

The local civil day begins twelve hours before and ends twelve hours after the sun passes the meridian of a place. As the globe is constantly revolving on its axis, a fresh meridian is every moment coming under the sun. As a consequence, a day is always beginning somewhere and always ending somewhere. Each spot around the circumference of the sphere has its own day, and therefore there are during every diurnal revolution of the earth, an infinite number of local days, all beginning with a space of twenty-four hours, and each continuing twenty-four hours. These days overlap each other, and, theoretically, they are as perfectly distinct as they are infinite in number. There are no simultaneous days except on the same meridian, and as the different days are always in the various stages of advancement, difficulties must necessarily result in assigning the period when an event takes place. The telegraph may give the exact local time of the occurrence, but it will be in disagreement with the local times on every other meridian around the earth. An event occurring any one day may on the instant be announced somewhere the previous day, or somewhere else the following day. About the

period when one month or year passes into another month or year, an occurrence may actually take place in two different months, or in two different years, according to local reckoning.

It will be readily conceded that this system is extremely unscientific, that it possesses all the elements of confusion, and produces a degree of ambiguity which cannot long be tolerated, that as time rolls on, it will lead to grave complications in social and commercial affairs, that it will produce serious errors in chronology, that it will lead to litigation, and result generally in difficulties of various kinds. According to our present system there can be no absolute certainty with regard to time unless the precise geographical position be specified as an important element of the date. It is evident that it will be exceedingly inconvenient and troublesome when rapid intercourse becomes universal to bring the times of different countries and localities into agreement; and that the necessity for doing so by additions or deductions for differences in longitude, will undoubtedly clog the ordinary business of the world.

It is proposed to obviate the difficulty by a system of cosmopolitan time-reckoning, the chief peculiarity of which is the adoption of one particular meridian as a standard time-zero, and by an extremely simple arrangement regulating the times at all places on the globe by a direct reference to the common standard. It is obvious that the world's time-zero should coincide with the prime meridian to be used in common by all nations for reckoning terrestial longitudes.

I shall proceed to submit special and more urgent reasons for the selection of a common initial Meridian and Time-zero. I shall confine my observations to the case of North America, a country with which I am most familiar, but the remarks I shall venture to submit will doubtless apply to other great divisions of the earth's surface.

The gigantic system of railways and telegraphs which has been established in America, has developed social and commercial conditions which never previously existed in the history of the human race. These conditions have affected the relations of time and distance in a manner which shows that the system of notation which we have inherited is defective, that it leads to confusion, causes loss of time, and disturbs the arrangements of travellers and business men. that it frequently results in loss of life, and leads to difficulties of various kinds, that under the circumstances which have followed the extensive employment of steam and electricity as means of rapid communication, it is generally inappropriate.

This question has therefore become a matter of great public importance, and attention is seriously directed to the simplest and best means of removing an impediment to commerce and general intercourse.

The system which we follow, and which has been followed for ages, was quite unobjectionable half a century ago, when the electric tele-

graph was unknown and the horse was almost the only locomotive. The system is based on the theory that time is regulated everywhere by the passage of the sun over the meridian of each separate locality, that the period between any two solar passages, at any one place, is divided into halves, known as *ante-meridian* and *post-meridian*, each half being subdivided into twelve hours, and that the two halves together constitute a day.

According to the recognised theory, as already stated, every spot on the surface of the globe differing in longitude has an entirely distinct day, and a local time peculiar to itself. Except on the same meridian there are no simultaneous days, or hours or minutes. Everywhere the days and divisions of the day vary, and the variations are infinite.

In the case of North America the continent extends across one hundred and five degrees of longitude. Within its extreme eastern and western limits it is possible to draw many thousand distinct meridians, and following rigidly the prescribed theory, we may have as many thousand standards of time, not two of which would be in harmony. The railway authorities have come face to face with the difficulty, and they have from time to time met it as circumstances dictated. In order to operate the long line of railway with some degree of safety, each separate manager has been obliged to ignore the different local times and arbitrarily adopt a special time for the movement of trains on the particular lines under his charge. The railway guide books publish at least seventy-five (75) irregularly chosen standards of time, employed for the running of trains in the United States and Canada. Every city and town of importance has its own time, occasionally coinciding, but frequently differing from the nearest railway standard. The public have been obliged to accommodate themselves to this irregular system, but it has become exceedingly inconvenient and irksome, and a scheme which will introduce a time-system characterized by uniformity and simplicity cannot fail to be cordially welcomed.

For the reasons stated, an earnest movement has begun in America with the view of establishing reform in time-reckoning. The question is engaging the attention of the Canadian Institute, the American Metrological Society, the American Society of Civil Engineers, the American Association for the Advancement of Science, and other Societies. The community generally and the great railway and telegraph interests are being awakened to its importance.

It is felt that the question is one in which all countries have an interest, and although it has presented itself perhaps more prominently in America than elsewhere, it is eminently desirable that Americans should take no narrow view of a scientific matter of world-wide interest.

It is held by those who have seriously considered the subject, that a solution of the problem which would be good for America would be advantageous for other countries. It is considered that in introducing a reform in time-reckoning in North America the system should be such as would commend itself generally; that it should be one which by its appropriateness and simplicity would have every prospect of being adopted ultimately throughout the world.

A highly important feature of the movement is to employ every means to render the system generally acceptable, so that whenever the necessity may arise in any other community for its introduction it may be spontaneously adopted—a course calculated to secure ultimately complete uniformity in all countries.

I shall give in brief an outline of a proposition for defining and regulating civil time which is favoured in many quarters in Canada and the United States of America:—

1. It is proposed to establish one standard time which may be common to all people throughout the world, for communication by land and sea, for all ordinary purposes, for synchronous observations, and for all scientific purposes. This standard time to be known as *Cosmopolitan Time.**

2. Cosmopolitan Time to be based on the diurnal revolutions of the earth as determined by the (mean) sun's passage over one particular meridian to be selected as a Time-zero.

3. The Time-zero to coincide with the Prime Meridian to be common to all nations for computing longitude.

4. The Time-zero and Prime Meridian for the world to be established with the concurrence of civilized nations generally.

5. Twenty-four secondary or standard Hour-meridians to be established, fifteen degrees or one hour distant from each other, the first being fifteen degrees from the Prime Meridian.

6. The standard Hour-meridians to regulate time at all places on the earth's surface.

7. The twenty-four standard Meridians to be denoted by symbols, and, preferably, by the letters of the English alphabet, which, omitting J and V, are twenty-four in number. The letters to be taken in their order from east to west. The Zero-meridian being lettered Z.

8. The hour of the day at any place on the earth's surface to be regulated by some one of the standard Meridians, generally by the standard nearest such place in longitude.

9. It is proposed to distinguish that interval of time between two consecutive passages of the (mean) sun over the Prime Meridian by the term *Cosmopolitan Day.*

10. The Cosmopolitan Day is designed to promote exactness in chronology, and is intended to be employed in connection

* The term "Cosmic" since suggested, commends itself.

with synchronous observations in all parts of the world, and for scientific purposes generally.

11. Local days to commence twelve hours before, and end twelve hours after the (mean) sun's passage over each of the standard Meridians. The local days to be distinguished by the letters of the twenty-four Meridians which determine them.

12. Local days will be reduced to twenty-four in number within the period of each diurnal revolution of the earth. They are to be regarded in the same light in all ordinary affairs as local days under the present system.

13. The hours of the *Cosmopolitan Day* to be known by the letters of the alphabet in their order from A to Z (omitting J and V), corresponding with the twenty-four Hour-meridians. When the (mean) sun passes Meridians G or N, it will be G time or N time of the *Cosmopolitan Day.*

14. It is proposed to abandon the divisions of the local day into two sets of hours, each numbered from one to twelve, and to employ a single series numbered from one to twenty-four without interruption; or as an alternative plan, to number the twelve hours from midnight to noon, as at present, and to letter the hours from noon to midnight. The afternoon letters being in agreement with the proper Cosmopolitan Time letters.

15. The time determined directly from the Prime Meridian, as in the Cosmopolitan Day, to be known by the general term *Cosmopolitan Time.*

16. Local time to be known by the particular standard Meridian to which it is referred. If it be determined by Meridian B it will be designated *Standard B Time.*

17. It is proposed to have standard time determined and disseminated under Governmental authority.

18. Each city and town of importance to have a public time-signal station electrically connected with a central observatory for the purpose of receiving and disseminating standard time with precision.

19. Each time signal station to be provided with automatical apparatus for dropping time-balls, or otherwise denoting the standard time hourly, or as often as circumstances may require.

20. All railway and local public clocks to be controlled electrically from the public time-signal stations.

The foregoing is a general outline of the proposition. It must be evident that the system of Cosmopolitan time would be a ready means of meeting the difficulties to which I have referred. It would render it practicable to secure uniformity, great simplicity, perfect accuracy, and complete harmony. The times of places widely differ-

ing in longitude would differ only by entire hours. In all other respects Standard time in every longitude and latitude would be in perfect agreement. In theory every clock in the world would indicate some one of the twenty-four hours at the same instant, and there would be perfect sychronism with the minutes and seconds everywhere around the globe.

By the system proposed, instead of an infinite and confusing number of local days following the sun during each diurnal revolution of the earth, we should have twenty-four well defined local days only; each local day would have a fixed relation to the others, and all would be governed by the position of the sun in respect to the Prime Meridian. These twenty-four local days would succeed each other at intervals of one hour during each successive diurnal revolution of the globe. The day of each locality would be known by the letter or other designation of its standard Meridian, and the general confusion and ambiguity which I have set forth as the consequences of the present system would cease to exist.

Some such system as that proposed is imperatively demanded in America. It cannot be doubted that the general adoption of the scheme portrayed would be conducive to the convenience of all mankind. The first step towards its introduction is the selection of an initial Meridian for the world. Accordingly I feel justified in asking you to favourably consider the resolutions which I have now the honour to submit.

RESOLUTIONS.

Resolved—1. That the unification of initial Meridians of reference for computing longitude is of great importance in the interests of geography and navigation.

Resolved—2. That the selection of a Zero-meridian for the world would greatly promote the cause of general uniformity and exactness in Time-reckoning.

Resolved—3. That in the interests of all mankind it is eminently desirable that civilized nations should come to an agreement with respect to the determination of a common Prime Meridian, and a system of universal Time-reckoning.

Resolved—4. That the Governments of different countries be appealed to immediately after the close of Congress, with the view of ascertaining if they would be disposed to assist in the matter by nominating persons to confer with each other and endeavour to reach a conclusion which they would recommend their respective Governments to adopt.

Resolved—5. That in view of the representations which have come to this Congress from America it is suggested that a Conference of Delegates who may be appointed by the different Governments be held in the City of Washington, and that the Conference open on the first Monday in May, 1882.

Resolved—6. That the gentlemen whose names follow be an Executive Committee to make arrangements for the proposed Meeting of Delegates, and to take such steps as may seem expedient in furtherance of the objects of these resolutions. And that all communications in respect thereof be transmitted to General W. B. Hazen, Meteorological Bureau, War Department, Washington.

DR. F. A. P. BARNARD, *President of American Metrological Society, New York.*

CAPTAIN GEORGE M. WHEELER, *Corps of Engineers, U. S. A., Washington.*

CHIEF JUSTICE DALY, *President of the American Geographical Society, New York.*

JUSTICE FIELD, *Supreme Court, Washington.*

GENERAL G. W. CULLUM, *Vice-President American Geographical Society, New York.*

GENERAL W. B. HAZEN, *Director of Meteorological Bureau, Washington.*

JUDGE PEABODY, *American Geographical Society, New York.*

PROFESSOR CLEVELAND ABBE, *Signal Office, Washington.*

DAVID DUDLEY FIELD, *American Geographical Society, New York.*

JAMES B. FRANCIS, *President of the American Society of Civil Engineers, Boston.*

DR. DANIEL WILSON, *President of Toronto University, Toronto.*

JOHN LANGTON, *President of the Canadian Institute, Toronto.*

SANDFORD FLEMING, *Chancellor of Queen's University of Canada, Kingston.*

Resolved—7. That the Italian Government be respectfully requested to communicate these resolutions to the Governments of all other countries.

After full discussion the Committee agreed to report favourably, and recorded the following minute :—

[TRANSLATION.]

The Committee considers that within a year an International Commission may be appointed by the Governments to consider the question of an Initial Meridian, having in view not only the question of longitude but specially that of hours and dates. The Commission should be composed of scientific men, such as geodicians, geographers and men who represent the interests of commerce, etc. Three members might be named by each nation. The President of the Italian Geographical Society is requested to take the initiative in bringing the subject before his Government and foreign Geographical Societies, and to take the necessary steps for the realization of the wish

expressed in the resolutions. Without deciding, the Committee desires to draw attention to the proposition of the American Delegates that the proposed International Commission should meet at Washington.

REMARKS ON THE COSMOPOLITAN SCHEME FOR REGULATING TIME.

By Professor Simon Newcomb, *Superintendent of Nautical Almanac, Washington, 1882.*

A capital plan for use during the millennium. Too perfect for the present state of humanity. See no more reason for considering Europe in the matter than for considering the inhabitants of the planet Mars.

No; we don't care for other nations, can't help them, and they can't help us.

PROCEEDINGS OF THE ITALIAN GEOGRAPHICAL SOCIETY.

Examination of the scheme of Time reform; from the work of M. Ferdinando Borsari, 1883.

(translation.)

Is Universal Time possible? *

The question of the choice of a Cosmopolitan Meridian being determined, it remains to be seen to what extent it may be possible to carry into effect in different countries the propositions of Mr. Sandford Fleming and of the other Americans interested in the introduction of the system of Cosmic Time and of twenty-four different systems of local Time, each in succession differing from the other by one hour.

The form given to this proposition, moreover, the very extraordinary clearness with which it has been set forth (see Part II.), is marked by much logic, so that a profitable and well-considered investigation of it may be held. Nevertheless, there is strong reason why we should not deceive ourselves as to the difficulties to be overcome. The idea relative to the introduction of the one Time in all countries will need a long period to popularize it in Europe, and to enter, so to say, into the convictions of the majority; and many of the propositions of Mr. Sandford Fleming (above all, that relative to local Time,) will perhaps encounter much insurmountable difficulty from the inhabitants of different countries, besides striking against several national traditions.

In our opinion, the most serious obstacle consists in the fact that there is no means in the different countries to bring Cosmopolitan

* Extracts from Il Meridiano Miziale e L'Ora Universale, Studio di Ferdinando Borsari Socio a vita della Società Geografica Italiana, Direttore della rassegna geografica a L'Esplorazione. Napoli, 1883. (Page 62.)

Time into accord with the rising and setting of the sun—phenomena which, as we say, necessarily regulate all the ordinary occupations of human life.

Besides, there is another fact which would confirm the necessity of maintaining the present national hours, in place of adopting the secondary Time proposed by Mr. Sandford Fleming, even should Cosmopolitan Time be universally adopted. It presents itself in this form :—At present the political boundary of the several States of Europe establishes the limit throughout which the recognized national date would cease to be used, *e. g.*, that of Rome, and at which commences the use throughout of the other national dates, *e. g.*, that of Paris, with regard to which nothing equivocal can take place. But supposing this national hour was suppressed and the secondary hour adopted, very many, with the exception of the astronomers, would not be gifted with the precise knowledge at what place the use of one date should cease and the other day of the secondary hour commence. In the hypothesis that the initial anti-meridian of Greenwich should be adopted, it would thence arise that a part of Spain would use the Meridian M, and the other the Meridian N ; the dividing line would be the Meridian situate at $187\frac{1}{2}^\circ$ of longitude (with the new system it would be no longer necessary to adjoin east or west, for longitude would be counted from east to west), and all the countries situated to the east of this line would use the Meridian M, and that of the west the Meridian N. But how in practice to obtain this separation ? But admitting even that it be obtainable, would it be possible to have part of the same country (in Spain as in Switzerland, in Germany, &c.,) with a system of Time different to that used in another part. We do not believe this determination by hour possible, at least in political life.

But the question presents itself under another aspect when we speak only of scientific consideration. And without doubt in any science, as, for example, astronomy, meteorology, in part terrestrial physics, and generally in all scientific questions connected with the exact determination of time, the universal adoption of Cosmopolitan Time would be a precious advantage, and would be brought to pass without difficulty. It would save many useless calculations, much loss of time, and would remove much misconception. Moreover, equally, we must acknowledge, that in other scientific questions the use of local Time owing to its agreement with the phenomena of the rising and setting of the sun would be preferable.

Therefore at the present time we ought to recommend the adoption of Cosmopolitan Time in all the branches of science in which, without inconvenience, it can be introduced, with the possibility of extending it hereafter ; moreover, in all public services in the departments bearing upon international relations.

The general adoption also of one of the propositions of Mr. Sandford Fleming, that relative to the enumeration of the hours of the day in a single series of 1 to 24, would probably encounter many obstacles; but its introduction should be advocated in all countries.

In fact, as we see, the division of the day into two halves, each of 12 hours, is a cause of numerous errors and inconveniences. This division has been for a long time in use. But undoubtedly apart from this reason no one can find any ground for its advocacy. Hence it comes to pass that its abolition is desirable, and that the simple division of the day into 24 hours should be established.

The example of so many places in Italy, in Bohemia, and in Poland, where this most simple division is observed at the present time, proves that its general introduction would meet with no difficulty, and that this beneficial reform could be effected without serious inconvenience; and that, besides, the logical consequence equally follows, of the possibility of the adoption of one Universal Time.

To resume: We consider we are justified in urging that, as soon as possible, the following reforms be adopted:—

1. The adoption of an initial Meridian common to all nations, the choice to be made at a conference of delegates.

2. The adoption of Cosmopolitan Time, based on this same universal Meridian, on which, moreover, naturally shall be based the computation of dates.

3. Adoption of one series of hours in one continuous day of 1 to to 24, suppressing the denominations of *anti* and *post* meridian.

4. The question of secondary Time requires to be more considered, at least in Europe. For the present we would prefer to see the national hours maintained, or, at most, we would prefer the proposition of the Swedish Commission.

* * * *

Conclusion.

Having arrived at the end of this work, we believe it is our duty to justify ourselves with the reader by some additional remarks, which may appear superfluous. But by what has been done, it will be clearly apparent that some consideration should be given to the subject. It may be said to be entirely new in the scientific and geographical publications of Italy; which fact, in itself, has imposed the obligation of examining the question under its many and various aspects; when it is considered, besides, that almost all the foreign scientific and geographical publications also give the question a special prominence, either in defence of a given Meridian, or in commenting on some of the propositions which we have set forth, there is required at this time a *résumé* which all can understand; and it is now so much the more called for, as it is likely, by the invitation of the United States of America,

an International Conference will be assembled to examine the problem which we have studied.

It may now be permitted us to express the wish that the Italian Government will encourage and support the above alluded-to reunion. All civilized nations are under plain obligations to science, but Italy, from her scientific traditions, more particularly so. The country of Columbus and Galileo ought never to forget herself, and it will be no trivial honour to Italy, as indeed to all civilized nations, to sanction a reform of so much interest to science and navigation.

Whether one initial Meridian or another be adopted, is of secondary importance. What is essential is that all should agree in their decision, and all who are interested in the progress of science and civilization should strive for this result. We predict that in a short time it will be accomplished.

REPORT ON THE WASHINGTON INTERNATIONAL CONFERENCE BY MR. SANDFORD FLEMING, DELEGATE OF GREAT BRITAIN REPRESENTING THE DOMINION OF CANADA.

OTTAWA, 31st, December, 1884.

The Hon. J. A. Chapleau, Secretary of State, Canada :

SIR,—I have the honour to report for the information of His Excellency the Governor-General in Council, the proceedings of the International Conference held at Washington, for the purpose of determining a Prime Meridian and establishing a Universal Day.

I should have done so earlier, but I have only within the past few days received copies of the Protocols of the proceedings, in French and English, to place in your hands.

The Conference was held in October last. Delegates assembled representing twenty-five nationalities, viz. :—Austria, Hungary, Brazil, Chili, Columbia, Costa Rica, France, Germany, Great Britain, Guatemala, Hawaii, Italy, Japan, Liberia, Mexico, the Netherlands, Paraguay, Russia, San Domingo, Turkey, Venezuela, the United States, St. Salvador.

It was attended by myself as a delegate of Great Britain appointed to represent the Dominion of Canada.

The following gentlemen were also present on the part of Great Britain :—

1. Captain Sir F. J. O. Evans, Royal Navy.
2. Professor J. C. Adams, Director of Cambridge University.
3. Lieutenant-General Strachey, member of the Council of India.

The Delegates assembled upon the invitation of the President of the United States. They met in Conference in the Diplomatic Hall

of the Department of State. Eight sessions were held, viz. :—On October 1st, 2nd, 6th, 13th, 14th, 20th, 22nd, and on the 1st November.

After patient and careful discussion the following resolutions were carried, the Delegates, according to usage, voting by nations :—

I.

"That it is the opinion of this Conference that it is desirable to adopt a single Prime Meridian for all Nations in place of the multiplicity of initial Meridians which now exist."—*Unanimously adopted.*

II.

"That the Conference proposes to the Governments here represented the adoption of the Meridian passing through the centre of the transit instrument at the Observatory of Greenwich as the initial Meridian for longitude."—*Adopted.*

Yeas, 22. Nays, 1. Abstaining, 2.

III.

"That from this Meridian longitude shall be counted in two directions up to 180 degrees, east longitude being *plus* and west longitude *minus*."—*Adopted.*

Yeas, 14. Nays, 5. Abstaining, 6.

IV.

"That the Conference proposes the adoption of a Universal Day for all purposes for which it may be found convenient, and which shall not interfere with the use of local or other standard time where desirable."—*Adopted.*

Yeas, 23. Nays, 0. Abstaining, 2.

V.

"That this Universal Day is to be a mean solar day, is to begin for all the world at the moment of mean midnight of the initial Meridian, coinciding with the beginning of the civil day and date of that Meridian, and is to be counted from zero up to twenty-four hours."—*Adopted.*

Yeas, 15. Nays, 2. Abstaining, 7.

VI.

"That the Conference expresses the hope that as soon as may be practicable the astronomical and nautical days will be arranged everywhere to begin at mean midnight,"—*Carried without division.*

VII.

"That the Conference expresses the hope that the technical studies designed to regulate and extend the application of the decimal system to the division of angular space and of time shall be resumed so as to permit the extension of this application to all cases in which it presents real advantages."—*Adopted.*

Yeas, 21. Nays, 0. Abstaining, 3.

It was further resolved unanimously,

"That a copy of the resolutions passed by the Conference shall be communicated to the Government of the United States of America, at whose instance and within whose territory the Conference has been convened."

It will also be seen on reference to the proceedings of the last session that the thanks of the Conference were given to the President, Admiral Rodgers, of the United States Navy, and to the Sec-

retaries, General Strachey, Delegate of Great Britain, M. Janssen, Delegate of France, and Dr. Luiz Cruls, Delegate of Brazil. I was unable to attend the meeting when these votes of thanks were passed. It is most gratifying to me here to place on record my sense of the unvarying courtesy and ability on all occasions shown by the presiding officers of the Conference and by the Secretaries.

The resolutions of greatest public importance are numbers one and two, four and five. Numbers one and two relate to the determination of a Prime Meridian; numbers four and five to the establishment of the Universal Day.

The question of the Prime Meridian was not settled without argument and divergence of view. It was one, indeed, on which some national sensitiveness was to be looked for. The Delegates of France approached the discussion with marked earnestness. They presented a resolution claiming that the Meridian to be selected should possess a character of absolute neutrality. "It should," ran the resolution (page 36), "be chosen exclusively so as to secure to science and to international commerce all possible advantages, and especially cut no great continent, neither Europe nor America."

Under the circumstances I felt it my duty to submit the remarks given in the protocol of the fourth session (pp. 75, 80).* I endeavoured to argue that our deliberations should take into consideration future demands and emergencies, while at the same time our decisions should cause as little interference as possible with present customs, and that we should consult the convenience of the greatest number; that we should especially regard national sensitiveness. I contended that to choose and recommend a neutral Meridian would simply be an attempt to establish an entirely new Meridian, one not in use by any individual nationality or by the shipping of any country. Even if such were recommended by the majority of Delegates there would be no guarantee, indeed there was no probability, that it would be accepted by any one of the twenty-five nationalities represented at the Conference. Eleven Meridians are already in use as zeros of longitude. The proposition, if it led to any result, would create a twelfth Meridian, and it would practically increase the difficulty we were endeavouring to remove.

The advantages to sea-going vessels having one common zero of longitude were incalculable. They had been alluded to by the President of the Conference in his opening address. I expressed my concurrence with his views, and pointed out that by the judicious establishment of the Prime Meridian we could the more readily reach the question of Universal Time. It was not from any national reason that the Meridian of Greenwich suggested itself as the one to be chosen. It was because of its convenience and its general use by the great majority of sea-going ships.

* Appended, page 74.

If the Meridian of Greenwich were established it would possess simply the character which its selection by the Conference would give it. It would become the Prime Meridian of the whole world—its national character would disappear. The words "Greenwich Meridian" would really have no place upon charts. The proper terms to be used by all hydrographers and navigators would be "Prime Meridian" or "Zero."

The vote for the Meridian of Greenwich was nearly unanimous, only one nation, San Domingo, voting against it. But before the vote was arrived at I deemed it proper, in order to meet the objections that had been raised, to submit a proposition leaving it an open question, to be settled by a subsequent vote, whether the choice should fall on the Meridian or anti-Meridian of Greenwich.

This proposition did not receive support. The majority felt the question was best decided by the direct motion establishing the Meridian of Greenwich as the Prime Meridian.

It will be seen by the third resolution that the mode of reckoning longitude remains unchanged—it is to be counted in two directions from the Prime Meridian up to 180 degrees, east longitude *plus* and west longitude *minus*.

Looking to the ulterior proceedings of the Conference, I felt it my duty to point out that a new nomenclature of longitude could be advantageously introduced; that although inconveniences would at first be felt in effecting a change in a custom so long followed, these would be far outweighed by the general benefits to be derived in future years. My own feeling was in favour of extreme simplicity of system, of a notation in complete harmony with the scheme of Universal Time. I held that it would be best to abandon counting longitude in two directions; that it should be reckoned in one direction only; that the Meridians should be numbered continuously from zero towards the west, avoiding the expressions *plus* and *minus* to denote east and west longitude.

Various authorities may be cited in support of these views. According to the distinguished astronomer, Sir John Herschel, longitude may be expressed in hours equally as well as in degrees, and "it would add greatly to systematic regularity, and tend much to avoid confusion and ambiguity in computations, were this mode of expression (longitude East and West) abandoned and longitudes reckoned invariably westward from their origin, around the whole circle."

In view of the adoption of Universal Time, it seemed to me obvious that great benefits would result if longitudes were reckoned on the same principle and known by the same terms as those which would be used in the new system of Time. I venture to draw attention to the remarks which I felt called upon to submit on the point (pp. 116,

122, and 124).* My own colleagues from Great Britain were not in accord with these views.

When the question of Universal Time was discussed, the Conference showed great unanimity with regard to its adoption for all purposes for which it may be found convenient. The principle was confirmed by the fourth resolution, and the division shows that while twenty-three nations voted in its favour, through their representatives, not a single delegate voted against the resolution.

The Universal Day is to be the mean Solar Day, commencing at the moment of mean mid-night of the Prime Meridian. The hours to be counted in one series up to twenty-four. Twelve o'clock of the new time will take place at the moment of mean noon at Greenwich, and the hours of the second half of the day will range from thirteen to twenty-four.

The resolution adopting the Prime Meridian having been carried, the establishment of a system of Universal Time became possible. I felt it my duty to submit the opinion I held on the question at some length (pp. 117, 125, and 181).† I endeavoured to point out that the condition of the age demanded a system of computing time which should have in view :

1. To secure chronological accuracy in dates common to the whole world.

1. To obtain a Standard of Time measurement, on a basis accepted by all nations, by which everywhere synchronously the same instant may be observed.

3. To establish a sound rational system of reckoning Time, which may eventually be adopted for civil purposes everywhere, and thus secure uniformity throughout the globe, with the greatest possible accuracy.

I ventured to submit to the Conference a series of recommendations designed to meet these ends. They embraced a scheme of Universal Time which, in its essential features, had for some years been under consideration by scientific bodies.

The Conference did not consider it necessary to decide upon details.

The resolutions passed are to the following effect, viz. :—

1. The advantages of Universal Time are recognized.

2. The Universal Day is defined.

3. While the Meridian of Greenwich is chosen as the Prime Meridian and the zero of longitude, the anti-Prime Meridian becomes the zero of Time.

4. The hours of the Universal Day are to be counted in one series from zero up to twenty-four.

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* Appended, page 77. † Appended, page 77 to 82.

5. The zero of the hours is the moment of mean solar passage on the anti-Prime Meridian. The first hour is at the moment of mean solar passage on the Meridian 15° west of the anti-Prime Meridian; the second and the remaining hours of the Universal Day come in turn at the solar passage on successive Meridians 15° of longitude apart, each Hour-meridian being an exact multiple of 15° from zero.

Thus a series of twenty-four Hour-meridians are practically determined around the globe, corresponding with the twenty-four hours of the Universal Day. A principle of uniformity will consequently be secured when the system of regulating civil time by Hour-standards comes to be adopted in other countries. It has already been acted upon in Canada and the United States with signal success.

I have already stated that the principle of Universal Time was adopted by the vote of twenty-three nations, and the division shows that while the representatives of two nations abstained from voting, no negative vote was cast against it. The recognition now given by authority to this new mode of Time-reckoning is of great importance. To my mind, it is far-reaching in its consequences, and obviously a step towards the unification of Time throughout the world. It will doubtless depend greatly on circumstances when and to what extent this new system will be introduced into civil life. No arbitrary line can be drawn to prescribe its applicability. It is only from use and convenience that the practical limit will be found. In course of years the uses and advantages of Universal Time will be better understood, and that which to this generation may appear strange and extraordinary, to the one succeeding may be regarded as regular and normal.

I trust I may be allowed to state that the principles of Universal Time adopted by the Conference are identical in character with those set forth in some papers which were published in Canada six years back. It was the Council of the Canadian Institute, Toronto, who took the initiative in bringing the subject before the world in 1879. This body memorialized the then Governor-General, Lord Lorne, on the subject, submitting documents on Time-reckoning and the selection of a Prime Meridian to be common to all nations. It was through His Excellency's official and personal weight and influence that copies of these papers were brought under the notice of the Imperial Government. Through the intervention of the Imperial Government they were submitted to the Governments of the civilized nations, and became known to men of science and high reputation. His Excellency evinced a deep interest in the question, and under his distinguished auspices the attention of Scientific Societies in Europe was first awakened to the subject.

More recently the Canadian Institute appointed a Delegate to the International Geographical Congress, held at Venice in 1881, to pro-

mote the discussion of the question. On this occasion the Canadian Delegate was permitted to submit a series of resolutions pointing out that it was eminently desirable that civilized nations should come to an agreement with respect to the determination of a common Prime Meridian and a system of Universal Time. The resolutions further suggested that Delegates should be appointed by the different Governments to meet in Conference at Washington to discuss these questions. The resolutions met with the active and cordial support of gentlemen from the United States representing Scientific Societies and the United States Government at the Venice Congress.

There cannot be a doubt that the proceedings at Venice led to the important action taken by the International Geodetic Congress at Rome in 1883, which in its turn has greatly assisted in preparing the way for the work of the Washington Conference.

On this side of the Atlantic, the Canadian Institute has not been the only active body. The progress of the movement has been greatly influenced by Societies in the United States, notably the American Metrological Society and the American Society of Civil Engineers. Those societies have systematically considered the question, and directed the attention of the public and the United States Government to it.

In submitting the proceedings of the Conference at Washington, I have alluded to some of the principal agencies which have operated to bring about the conclusion now reached. I trust that it will not be held an impropriety on my part thus dwelling upon the important part Canada has played in the establishment of Universal Time, and in the determination of an initial Prime Meridian for the world. With two copies of the protocols which I have the honour to enclose, I also forward copies of the documents issued by the Canadian Institute.

I have the honour to be,

Sir,

Your obedient servant,

SANDFORD FLEMING.

APPENDIX TO REPORT ON THE WASHINGTON CONFERENCE.

Extract (1) from the Protocols of Session, October 13th, referred to in the foregoing Report, page 69.

Mr. Sandford Fleming, Delegate of Great Britain:—I have listened with great attention and deep interest to the remarks which have fallen from the several gentlemen who have spoken, and I desire your kind indulgence for a few moments while I explain the views I have formed on the motion of the distinguished Delegates from France.

I feel that the important question which this Conference has to consider must be approached in no narrow spirit. It is one which affects every nationality, and we should endeavour, in the common interest, to set aside any national or individual prejudices we possess, and view the subject as members of one community—in fact, as citizens of the world. Acting in this broad spirit, we cannot fail to arrive at conclusions which will promote the common good of mankind.

In deliberating on the important subject before us, it seems to me there are two essential points which we should constantly bear in mind.

1. We should consider what will best promote the general advantage, not now only, but for all future years, while causing at the present time as little individual and national inconvenience as possible.

2. We should, in coming to a determination on the main question for which this Conference is called, leave nothing undone to avoid offence, now or hereafter, to the sensitiveness of individual nations.

The motion is, that the initial meridian to be chosen should be selected on account of its neutrality. This undoubtedly involves the selection of an entirely new meridian, one which has never previously been used by any nation, as all initial meridians in use are more or less national, and, as such, would not be considered neutral in the sense intended by the honourable Delegates from France.

Let us suppose that this Conference adopted the motion. Let us suppose, further, that we found a meridian quite independent of, and unrelated to any existing initial meridian. Would we then have accomplished the task for which we are met? I ask, would the twenty-six nations here represented accept our recommendation to adopt the neutral meridian? I greatly fear that the passing of the resolution would not in the least promote the settlement of the important question before the Conference. The world has already at least eleven different first meridians. The adoption of the new meridian contemplated by the Delegates from France would, I apprehend, simply increase the number and proportionately increase the difficulty which so many Delegates from all parts of the earth are assembled here to remove.

This would be the practical effect of the passing of the resolution. If it had any effect, it would increase the difficulty, and I need not say that is not the object which the different Governments had in view when they sent Delegates to this Conference. The President has well pointed out in his opening address the advantages which would be gained, and the great dangers which, at times, would be avoided by seafaring vessels having one common zero of longitude. Besides the benefits which would accrue to navigation, there are advantages of equal importance in connection with the regulation of Time, to spring, I trust, from our conclusions.

It does not appear to me that the adoption of the motion would in any way advance these objects. I do not say that the principle of a neutral meridian is wrong, but to attempt to establish one would, I feel satisfied, be productive of no good result. A neutral meridian is excellent in theory, but I fear it is en-

tirely beyond the domain of practicability. If such be the case, it becomes necessary to consider how far it would be practicable to secure the desired advantages by adopting as a zero some other meridian which, while related to some existing first meridian, would not be national in fact, and would have the same effect as a perfectly neutral meridian in allaying national susceptibilities.

The selection of an initial meridian related to meridians now in use gives us a sufficiently wide choice. Allow me to read the following list, showing the number and the total tonnage of vessels using the several meridians named, in ascertaining their longitude :—

INITIAL MERIDIANS.	Ships of all Kinds.		Per Cent.	
	Number.	Tonnage.	Ships.	Tonnage.
Greenwich	37,663	14,600,972	65	72
Paris	5,914	1,735,083	10	8
Cadiz	2,468	666,602	5	3
Naples	2,263	715,448	4	4
Christiania	2,128	695,988	4	3
Ferro	1,497	567,632	2	3
Pulkova	987	298,641	1½	1½
Stockholm	717	154,180	1½	1
Lisbon	491	164,000	1	1
Copenhagen	435	81,888	1	½
Rio de Janeiro	253	97,040	½	½
Miscellaneous	2,881	534,569	4½	2½
Total	57,697	20,312,093	100	100

It thus appears that one of these meridians, that of Greenwich, is used by 72 per cent. of the whole floating commerce of the world, while the remaining 28 per cent is divided among ten different initial meridians. If, then, the convenience of the greatest number alone should predominate, there can be no difficulty in a choice ; but Greenwich is a national meridian, and its use as an international zero awakens national susceptibilities. It is possible, however, to a great extent, to remove this objection by taking, for a zero of Longitude and Time, the meridian farthest distant from Greenwich. This being on the same great circle as Greenwich, it would not require the establishment of a new observatory ; its adoption would produce no change in charts or nautical tables, beyond the notation of longitude. It would possess all the advantage claimed for the Greenwich meridian in connection with navigation, and as a zero for regulating Time it would be greatly to be preferred to the Greenwich meridian. This Pacific meridian being accepted as the common zero, and longitude being reckoned continuously in one direction, there would be an end to the necessity of any nation engraving on its charts the word "longitude east or west of Greenwich." The one word, "Longitude" would suffice. The zero meridian would be international and in no respect national. Even on British charts all reference to Greenwich would disappear.

This view of the question is sustained by many distinguished men. I shall only ask permission to read the opinion of Mr. Otto Struve, Director of the Imperial Observatory at Pulkova, than whom there is no higher authority.

"The preference given to the Greenwich meridian was based, on one side, on the historical right of the Royal Observatory of England, acquired by eminent services rendered by this establishment during the course of two centuries, to mathematical geography and navigation ; on the other side, considering that the great majority of charts now in use upon all the seas are made according to this meridian, and about 90 per cent. of the navigators of long

standing are accustomed to take their longitude from this meridian. However, an objection against this proposition is, that the meridian of Greenwich passes through two countries of Europe, and thus the longitude would be reckoned by different signs in different portions of our own continent and also of Africa.

"Moreover, the close proximity of the meridian of Paris, which, perhaps, some French geographers and navigators of other nations would still hold to, from custom, from a spirit of contradiction or from national rivalry, might easily cause sad disaster. To obviate these inconveniences, I have proposed to choose as Prime meridian another meridian, situated at an integral number of hours east or west of Greenwich, and among the meridians meeting this condition, I have indicated, in the first place, the meridian proposed to-day by scientific Americans, as that which would combine the most favorable conditions for its adoption. Thus the meridian situated 180° from Greenwich presents the following advantages :—

"1. It does not cross any continent but the eastern extremity of the North of Asia, inhabited by people very few in number and little civilized, called Tschouktschis.

"2. It coincides exactly with that line where, after the custom introduced by a historical succession of maritime discoveries, the navigator makes a change of one unit in the date, a difference which is made near a number of small islands in the Pacific Ocean, discovered during the voyages made to the east and west. Thus the commencement of a new date would be identical with that of the hours of Cosmopolitan Time.

"3. It makes no change to the great majority of navigators and hydrographers, except the very simple addition of twelve hours, or of 180° to all longitudes.

"4. It does not involve any change in the calculations of the Ephemerides most in use among navigators, viz., the English Nautical Almanac, except turning mid-day into mid-night, and *vice versa*. In the American Nautical Almanac there would be no other change to introduce. With a cosmopolitan spirit, and in the just appreciation of a general want, the excellent Ephemerides published at Washington, record all data useful to navigators calculated from the meridian of Greenwich.

"For universal adoption, as proposed by the Canadian Institute, it recommends itself to the inhabitants of all civilized countries, by reason of the great difference in longitude, thus removing all the misunderstandings and uncertainties concerning the question, as to whether, in any case, Cosmopolitan or Local Time was used.

"In answer to the first question offered by the Institute at Toronto, I would, therefore, recommend the Academy to pronounce without hesitation in favour of the universal adoption of the meridian situated 180° from Greenwich, as Prime Meridian of the globe."

I quote from the report of M. Otto Struve to the Imperial Academy of Sciences of St. Petersburg, 30th Sept. 1880.

I respectfully submit, we have thus the means of solving the problem presented to us, without attempting to find such a meridian as that contemplated in the motion of the honorable delegates. Whatever its origin, the Pacific meridian referred to would soon be recognized as being as much neutral as any meridian could possibly be. If, on the other hand, we adopt the motion, I very greatly fear that the main object of this Conference will be defeated and the settlement of a question so pregnant with advantages to the world will be indefinitely postponed.

Extract (2) from the Protocols of Session, October 14th, referred to in the foregoing Report, page 71.

Mr. Sandford Fleming, Delegate of Great Britain, representing the Dominion of Canada:—I wish to offer some observations on the resolution before the Conference, but I am unable to separate the particular question from the general question. To my mind, longitude and time are so related that they are practically inseparable, and when I consider longitude, my thoughts naturally revert to time, by which it is measured. I trust, therefore, I may be permitted to extend my remarks somewhat beyond the immediate scope of the resolution. I agree with those who think that longitude should be reckoned in one direction only, and I am disposed to favour a mode of notation differing in other respects from that commonly followed.

If a system of universal time be brought into use, advantages would result from having the system of time and the system of terrestrial longitude in complete harmony. The passage of time is continuous, and, therefore, I think longitude should be reckoned continuously. To convey my meaning fully, however, it is necessary that I should enter into explanations at some length.

The adoption of a Prime Meridian, common to all nations, admits of the establishment of a system of reckoning time equally satisfactory to our reason and our necessities.

At present we are without such a system. The mode of notation followed by common usage from time immemorial, whatever its applicability to limited areas, when extended to a vast continent, with a net-work of lines of railway and telegraph, has led to confusion and created many difficulties. Further, it is insufficient for the purposes of scientific investigation, so marked a feature of modern inquiry.

Taking the globe as a whole, it is not now possible precisely to define when a year or a month or a week begins. There is no such interval of time as the commonly defined day everywhere and invariable. By our accepted definition, a day is local; it is limited to a single meridian. At some point on the earth's surface one day is always at its commencement and another always ending. Thus, while the earth makes one diurnal revolution, we have continually many days in different stages of progress on our planet.

Necessarily the hours and minutes partake of this normal irregularity. Clocks, the most perfect in mechanism, disagree if they differ in longitude. Indeed, if clocks are set to true time, as it is now understood, they must, at least in theory, vary not only in the same State or County, but to some extent in the same City.

As we contemplate the general advance in knowledge, we cannot but feel surprised that these ambiguities and anomalies should be found, especially as they have been so long known and felt. In the early conditions of the human race, when existence was free from the complications which civilization has led to; in the days when tribes followed pastoral pursuits and each community was isolated from the other; when commerce was confined to few cities, and intercommunication between distant countries rare and difficult; in those days there was no requirement for a common system of uniform time. No inconvenience was felt in each locality having its own separate and distinct reckoning. But the conditions under which we live are no longer the same. The application of science to the means of locomotion and to the instantaneous transmission of thought and speech have gradually contracted space and annihilated distance. The whole world is drawn into immediate neighbourhood and near relationship, and we have now become sensible to inconveniences and to many disturbing influences in our reckoning of time utterly unknown and even unthought of a few generations back. It is also quite manifest that, as civilization advances, such evils must greatly increase rather than be lessened, and that the true remedy lies in changing our traditional usages in respect to

the notation of days and hours, whatever shock it may give to old customs and he prejudices engendered by them.

In countries of limited extent, the difficulty is easily grappled with. By general understanding, an arrangement affecting the particular community may be observed, and the false principles which have led to the differences and disagreements can be set aside. In Great Britain the time of the Observatory at Greenwich is adopted for general use. But this involves a departure from the principles by whieh time is locally determined, and hence, if these principles be not wrong, every clock in the United Kingdom, except those on a line due north and south from Greenwich, must of necessity be in error.

On the continent of North America efforts have recently been made to adjust the difficulty. The steps taken have been in a high degree successful in providing a remedy for the disturbing influences referred to, and, at the same time, they are in harmony with principles, the soundness of which is indisputable.

When we examine into time in the abstract, the conviction is forced upon us that it bears no resemblance to any sort of matter which comes before our senses; it is immaterial, without form, without substance, without spiritual essence. It is neither solid, liquid, nor gaseous. Yet it is capable of measurement with the closest precision. Nevertheless, it may be doubted if anything measurable could be computed on principles more erroneous than those which now prevail with regard to it.

What course do we follow in reckoning time? Our system implies that there are innumerable conceptions designated "time." We speak of solar, astronomical, nautical, and civil time, of apparent and mean time. Moreover, we assign to every individual point around the surface of the earth separate and distinct times in equal variety. The usages inherited by us imply that there is an infinite number of times. Is not all this inconsistent with reason, and at variance with the cardinal truth, that there is *one time only?*

Time may be compared to a great stream forever flowing onward. To us, nature, in its widest amplitude, is a unity. We have but one Earth, but one Universe, whatever its myriad component parts. That there is also but one flow of Time is consistent with the plain dictates of our understanding. That there can be more than one passage of Time is inconceivable.

From every consideration, it is evident that the day has arrived when our method of Time-reckoning should be reformed. The conditions of modern civilization demand that a comprehensive system should be established, embodying the principal that *Time is one abstract conception*, and that all definite portions of it should be based on, or be related to, *one unit measure.*

On these grounds I feel justified in respectfully asking the consideration of the Conference to the series of recommendations which I venture to submit.

The matter is undoubtedly one in which every civilized nation is interested. Indeed, it may be said that, more or less, every human being is concerned in it. The problem is of universal importance, and its solution can alone be found in the general adoption of a system grounded on principles recognized as incontrovertible.

Such principles are embodied in the recommendations which I am permitted to place before the Conference. They involve, as an essential requirement, the determination of a unit of measurement, and it is obvious that such a unit must have its origin in the motion of the heavenly bodies. No motion is more uniform than the motion of the earth on its axis. This diurnal revolution admits of the most delicate measurement, and, in all respects, is the most available for a unit measure. It furnishes a division of time definite and precise, and one which, without difficulty, can be made plain and manifest.

A revolution of the earth, denoted by the mean solar passage at the Prime or Anti-prime Meridian, will be recognizable by the whole world as a period of time common to all. By general agreement this period may be regarded as the common unit by which Time may be everywhere measured for every purpose in science, in commerce, and in every-day life.

The scheme set forth in the recommendations has in view three principal objects, viz :

1. To define and establish an Universal Day for securing chronological accuracy in dates common to the whole world.

2. To obtain a system of Universal Time on a basis acceptable to all nations, by which, everywhere, at the same time, the same instant may be observed.

3. To establish a sound and rational system of reckoning Time which may eventually be adopted for civil purposes everywhere, and thus secure uniformity and accuracy throughout the globe.

But, in the inauguration of a scheme affecting so many individuals, it is desirable not to interfere with prevailing customs more than necessary. Such influences as arise from habit are powerful and cannot be ignored. The fact must be recognized that it will be difficult to change immediately the usages to which the mass of men have been accustomed. In daily life we are in the habit of eating, sleeping, and following the routine of our existence at certain periods of the day. We are familiar with the numbers of the hours by which these periods are known, and, doubtless, there will be many who will see little reason in any attempt to alter their nomenclature, especially those who take little note of cause and effect, and who, with difficulty, understand the necessity of a remedy to some marked irregularity, which, however generally objectionable, does not bear heavily upon them individually.

For the present, therefore, we must adapt a new system, as best we are able, to the habits of men and women as we find them. Provision for such adaptation is made in the recommendations by which, while local reckoning would be based on the principles laid down, the hours and their numbers need not appreciably vary from those with which we are familiar. Thus, Time-reckoning in all ordinary affairs in every locality may be made to harmonize with the general system.

Standard Time throughout the United States and Canada has been established in accord with this principle. Its adoption has proved the advantages which may be attained generally by the same means. On all sides these advantages have been widely appreciated, and no change intimately bearing upon common life was ever so unanimously accepted. Certainly, it is an important step towards the establishment of one system of Universal Time, or, as it is designated in the recommendations, Cosmic Time.

The alacrity and unanimity with which the change has been accepted in North America encourages the belief that the introduction of Cosmic Time in every-day life is not unattainable. The intelligence of the people will not fail to discover before long, that the adoption of correct principles of Time-reckoning will in no way change or seriously affect the habits they have been accustomed to. It will certainly sweep away nothing valuable to them. The sun will rise and set to regulate their social affairs. All classes will soon learn to understand the hour of noon, whatever the number on the dial, whether six, as in Scriptural times, or twelve, or eighteen, or any other number. People will get up and retire to bed, begin and end work, take breakfast and dinner at the same periods of the day as at present, and our social habits and customs will remain without a change, depending, as now, on the daily returning phenomena of light and darkness.

The one alteration will be in the notation of the hours, so as to secure uniformity in every longitude. It is to be expected that this change will at first create some bewilderment, and that it will be somewhat difficult to be under-

stood by the masses. The causes for such a change to many will appear insufficient or fanciful. In a few years, however, this feeling must pass away, and the advantages to be gained will become so manifest that I do not doubt so desirable a reform will eventually commend itself to general favour, and be adopted in all the affairs of life.

Be that as it may, it seems to me highly important that a comprehensive Time-system should be initiated to facilitate scientific observations, and definitely to establish chronological dates ; that it should be designed for general use in connection with railways and telegraphs, and for such other purposes for which it may be found convenient.

The Cosmic Day set forth in the recommendations would be the date for the world recognizable by all nations. It would theoretically and practically be the mean of all local days, and the common standard to which all local reckonings would be referable.

With regard to the reckoning of longitude, I submit that Longitude and Time are so intimately related that they may be expressed by a common notation. Longitude is simply the angle formed by two planes passing through the earth's axis, while Time is the period occupied by the earth in rotating through that angle. If we adopt the system of measuring Time by the revolution of the earth from a recognized zero, one of these planes—that through the zero—may be considered fixed ; the other—that through the meridian of the place—being movable, the longitudinal angle is variable. Obviously the variable angle ought to be measured from the fixed plane as zero, and as the motion of the earth by which the equivalent time of the angle is measured is continuous, the longitude ought to be reckoned continuously in one direction. The direction is determined by the notation of the Hour-meridians, viz., from east to west.

If Longitude be so reckoned and denoted by the terms used in the notation of Cosmic Time, the time of day everywhere throughout the globe would invariably denote the precise longitude of the place directly under the mean sun. Conversely, at the epoch of mean solar passage at any place, the Longitude being known, Cosmic Time would be one and the same with the Longitude of the place.

The advantages of such a system of reckoning and nomenclature, as suggested in the recommendations which I now submit, will be, I think, self-evident.

RECOMMENDATIONS FOR THE REGULATION OF TIME AND THE RECKONING OF LONGITUDE.

1. *That a system of Universal Time be established, with the view of facilitating synchronous scientific observations, for chronological reckonings, for the purpose of trade and commerce by sea and land, and for all such uses to which it is applicable.*

2. *That the system be established for the common observance of all peoples, and of such a character that it may be adopted by each separate community, as may be found expedient.*

3. *That the system be based on the principle that for all terrestrial Time-reckonings there be one recognized unit of measurement only, and that all measured intervals of Time be directly related to the one unit measure.*

4. *That the unit measure be the period occupied by the diurnal revolution of the earth, defined by the mean solar passage at the meridian twelve hours from the Prime Meridian established through Greenwich.*

5. *That the unit measure defined as above be held to be a Day absolute, and designated a Cosmic Day.*

6. *That such Cosmic Day be held as the chronological date of the earth, changing with the mean solar passage at the Anti-meridian of Greenwich.*

7. *That all divisions and multiples of the Cosmic Day be known as Cosmic Time.*

8. *That the Cosmic Day be divided into hours, numbered in a single series, one to twenty-four* (1 *to* 24), *and that the hours be sub-divided, as ordinary hours, into minutes and seconds.* NOTE.—*As an alternative means of distinguishing the Cosmic hours from the hours in local reckonings, they may be denoted by the letters of the alphabet, which, omitting I and V, are twenty-four in number.*

9. *That until Cosmic Time be admitted as the recognized means of reckoning in the ordinary affairs of life, it is advisable to assimilate the system to present usages, and to provide for the easy translation of local reckonings into Cosmic Time, and* vice versa ; *that, therefore, in theory, and as closely as possible in practice, local reckonings be based on a known interval in advance or behind Cosmic Time.*

10. *That the surface of the globe be divided by twenty-four equi-distant Hour-meridians, corresponding with the hours of the Cosmic Day.*

11. *That, as far as practicable, the several Hour-meridians be taken according to the longitude of the locality, to regulate local reckonings, in a manner similar to the system in use throughout North America.*

12. *That in all cases where an Hour-meridian is adopted as the standard for regulating local reckonings in a particular section or district, the civil day shall be held to commence twelve hours before, and end twelve hours after, the mean solar passage of such Hour Meridian.*

13. *That the civil day, based on the Prime Meridian of Greenwich, shall coincide and be one with the Cosmic Day. That civil days on meridians east of Greenwich shall be (according to the longitude) a known number of hours, or hours and minutes, in advance of Cosmic Time, and to the west of Greenwich the contrary.*

14. *That the surface of the globe being divided by twenty-four equi-distant meridians (fifteen degrees apart) corresponding with the hours of the Cosmic Day, it is advisable that longitude be reckoned according to these Hour-meridians.*

15. *That divisions of longitude less than an hour (fifteen degrees) be reckoned in minutes and seconds and parts of seconds.*

16. *That longitude be reckoned continuously towards the west, beginning with zero at the Anti-prime Meridian, twelve hours from Greenwich.*

17. *That longitude generally be denoted by the same terms as those applied to Cosmic Time.*

I submit these recommendations suggestively, and without any desire unduly to press them. I shall be content if the leading principles laid down be recognized by the Conference.

With regard to the more immediate question, I have come to the firm conviction that extreme simplicity of reckoning and corresponding benefits would result if Longitude be notated in the same manner, and denoted by the same terms, as Universal Time. If, therefore, the Conference adopts the motion of the distinguished Delegate of the United States, which, I apprehend, is designed to cause as little change as possible in the practices of sea-faring men, I trust the claims of other important interests will not be overlooked. I refer to all those interests so deeply concerned in securing accurate time on land, and in having easy means provided for translating any one local reckoning into any other local reckoning, or into the Standard Universal Time. In this view I trust the Conference will give some expression of opinion in favour of extending around the globe the system of Hour-meridians which has proved so advantageous in North America. In an educational aspect alone it seems to me important that the Hour-meridians, one to twenty-four, numbered from the Anti-prime Meridian continuously toward the west, should be conspicuously marked on our maps and charts.

Extract (3) from the Protocols of Session 20th October, referred to in the foregoing Report, page 71.

Mr. Sandford Fleming, Delegate of Great Britain:—To my mind it is of very great importance that this resolution should be adopted. I have already given generally my views on this question, and therefore I do not intend to trespass on the attention of the Conference beyond saying a very few words. From what I have already ventured to submit, it will be obvious that I hold that all our usages in respect to the reckoning of time are arbitrary. Of one thing there can be no doubt. There is only one, and there can only be one flow of Time, although our inherited usages have given us a chaotic number of arbitrary reckonings of this one conception. There can be no doubt of another matter ; the progress of civilization requires a simple and more rational system than we now possess. We have, it seems to me, reached a stage when a unification of the infinite number of time-reckonings is demanded.

This unification will be, to a large extent, accomplished if the resolution be adopted, and by adopting it, it seems to me to be in the power of the Conference to confer lasting benefits on the world.

Universal Time will in no way interfere with local time. Each separate community may continue in the usages of the past in respect to local time, or may accept whatever change the peculiar conditions in each case may call for. But the use of Universal Time will not necessarily involve a change ; it will rather be something added to what all now possess, and it will be a boon to those who avail themselves of it.

To the east of the Prime Meridian all possible local days will be in advance ; to the west all possible days will be behind the Universal Day.

The Universal Day, as defined by the resolution, will at once be the mean of all possible local days, and the standard to which they will all be related by a certain known interval, that interval being determined by the longitude.

In my judgment, the resolution is an exceedingly proper one, and the Conference will act wisely in passing it.

HIS EXCELLENCY THE GOVERNOR-GENERAL, CANADA, TO THE PRESIDENT OF THE CANADIAN INSTITUTE.

OFFICE OF THE GOVERNOR-GENERAL'S SECRETARY,
OTTAWA, 8th April, 1885.

SIR,—I have the honour, by desire of His Excellency the Governor-General, to transmit to you herewith a copy of a despatch (No. 48, 17th March,) from the Secretary of State for the Colonies, expressing the high appreciation of Her Majesty's Government of the services rendered by Mr. Sandford Fleming, C.M.G., in connection with the Prime Meridian Conference at Washington.

I have the honour to be.

Sir,

Your obedient servant,

CHARLES J. JONES,
For the Governor-General's Secretary.

The President Canadian Institute, Toronto.

THE EARL OF DERBY, SECRETARY OF STATE FOR THE COLONIES, TO HIS EXCELLENCY THE MARQUIS OF LANSDOWNE, GOVERNOR-GENERAL OF CANADA.

DOWNING STREET, 17th March, 1885.

MY LORD,—I have the honour to acknowledge the receipt of your Despatch No. 53, of the 24th ultimo, with its enclosures, respecting the proceedings of the Prime Meridian Conference at Washington.

I have caused the papers forwarded to be transmitted to the Science and Art Department.

I take this opportunity to request your Lordship to inform Mr. Sandford Fleming that Her Majesty's Government highly appreciate the services rendered by him in connection with this Conference.

I have, &c.,

DERBY.

GOVERNOR-GENERAL,
The Most Hon. the Marquis of Lansdowne, G.C.M.G., &c., &c., &c.

THE RESOLUTIONS OF THE WASHINGTON MERIDIAN CONFERENCE.

BY OTTO STRUVE,

DIRECTOR OF THE IMPERIAL ASTRONOMICAL OBSERVATORY, PULTOWA, RUSSIA.

[*Translated from the German, published in St. Petersburg, 1885.*]

It has been felt as a positive evil, for a long time, throughout the civilized world, and especially with geographers and navigators, that in different countries the degrees of geographical longitude are referred to different initial meridians. This multiplication of initial meridians to which, as they are in prominence, these lines of longitude are adapted, and which in each particular country correspond to the most important observatories, not only causes great complications by the contemporary use in different countries of the several published geographical maps, but is likewise for navigators a source of error which can easily lead to mischievous results, and indeed has so led to them. Therefore, for centuries the desire has been very widely entertained for the common acceptance by all nations of one and the same Meridian as the starting point for the enumeration of the lines of Longitude, by which means this evil would be removed. In the programme of the first Geographical Congress, proposed to be held at Antwerp, in the summer of 1870, public attention was specially directed to this question, as the most important subject for consideration; indeed to a certain extent as the chief object to be submitted to the Congress. On account of the German-French war, unfortunately the Congress called for that year was not held; and although since that date the same question has been the subject of preparatory discussion in later Congresses and Public Conferences, nevertheless the first decided advance in the matter was through the Congress of Delegates of almost every civilized country in the world, called together in October of last year, in Washington, by the Government of the United States of North America. The most important of the Resolutions adopted at this International Conference we design here somewhat closely to discuss.

It is proper to remark, that for a long period with us in Russia preparatory measures have been taken in the same direction as that which at the Washington Conference was suggested to be followed by the whole world. As a proof, it may be said that Mr. Struve, shortly after the successful establishment of the Chief Observatory in Pultowa, in the most positive manner pronounced against the establishment of a special First Meridian in Russian Cartography. In accordance with this view, in 1843–44 he organized the great Chronometer Expedition, by which the difference of Longitude between Pultowa and Greenwich was established with the utmost precision, so that in Russia we were in a position to lay down all lines of Longitude, determined or to be determined, with perfect correct-

ness with regard to the Meridian of the last named Observatory, which already at that time was the most generally in use.

His Imperial Highness the Grand Duke Constantine Nicolajewitch, also acted, in the same enlightened and liberal spirit, when in his position as High Admiral of the Russian Fleet, which, until 1853, had made use of a Nautical Almanack specially prepared for Russia, he cancelled its use, and in its place introduced into the Russian Navy the English Nautical Almanack, well known as based on the Greenwich Meridian, from which the *Morski Miesiatseslob* (Naval Almanac) was essentially a stunted re-production. A far more important step was taken, that since that period upon his order, the Lines of Longitude according to the Meridian of Greenwich are drawn on all Sea Charts produced by the Hydrographical Department, and only on the margin of the Map their relation to Pultowa is marked. In spite of this precedent, we have in the meantime remained not entirely free from the influence of the unwise feeling of nationality which has advanced the claim of Pultowa to be the First Meridian at least for Russia. It is owing to such national feeling that the fact must be explained that upon several Maps issued by the Head Quarter Staff, in contradiction to the views of the Pultowa astronomers, even in instances where the Maps have not simply a local interest, the Lines of Longitude are referred to Pultowa, and on the margin only the relation which that Meridian bears to Greenwich is shewn.

As already mentioned, this matter took a new phase through the Antwerp programme, and the interest we felt in the proceedings, became accordingly the more marked. Especially, the aim of the Unification of Longitude found a zealous representative in the person of the then President of the Imperial Academy of Sciences, Admiral Count Lütke. Among other matters he induced the present Director of the Pultowa Observatory publicly to set forth his views upon this question, and in accordance with this desire, the latter prepared a paper which he read at a general meeting of the Imperial Russian Geographical Society, held on the 4th February, 1870. In this paper, the conclusions of which the meeting approved, among other points discussed, the arguments which may be adduced in advocacy of the Meridian of Greenwich for universal acceptance as First Meridian, were sufficiently set forth. The argument suggested that should the immediate acceptance of this Meridian, on account of mistaken national feeling, obtain not only a merely apparent support, but on the other hand experience serious opposition from the circumstance, that it serves to determine longitude, as well for Great Britain as for France, conditionally on a change of notation, so might it be an acceptable arrangement that the First Meridian to be named should be drawn from that of Greenwich, at a given number of hours, without any addition of minutes and seconds. The reader of the paper under such circumstances took

upon himself to direct special attention to a Meridian twelve hours distant from Greenwich, which passes through firm land only in the high latitudes of the north in the uninhabited neighbourhood of Tschuktschenland, near Behring Straits, and for the remaining part of the distance runs through the Pacific Ocean and the two Arctic seas of ice. The establishment of this Meridian, which may be described as the nether Greenwich Meridian, would in any circumstance lead to fewer practical inconveniences than those incident to any other Meridian excepting that of Greenwich itself.

These views not only found much accord in this country, but were also favourably received abroad. A more earnest movement, therefore, for the Unification of Longitude notation took place for the first time, as it became associated with the desire after uniformity in the notation of time in international relations; while it became intimately connected with our Cartographical requirements, and even penetrated into practical life. It was principally the rapid development of the means of communication through railways and telegraphs which called this desire into life; especially in America where the increased communication and the great extent of country, making the question of time one of special importance, demanded some settlement of the matter.

Before we enter upon the proceedings of the Washington Conference it will, perhaps, be of advantage at this place to signify in a few words the objects to be attained by the unification of Time-notation which make that step desirable. All sciences are in common interested in the result. Navigation, the Administration of Telegraphs and Railways. Ordinary every-day life, which in its locality is regulated by the sun, would not immediately be affected by it.

In the first place, let us look at the signification of the Unification of Time with regard to science. Thus it is perfectly plain that besides astronomy those sciences are especially interested which have relation to the phenomena of the globe, namely Physics, Meteorology, and Magnetism. For the last named it is of importance that so far as possible, identity in the determination of Time should be established, according to which certain observations which have been or are to be made will be referred. It may for example be remembered that for some time past the local time of Göttingen has been used as the Normal Time for simultaneous magnetic observations, because from thence the first impulse to such observations was given through Gauss. Similar arrangements, it is true, may be made in each case in the future when there is a question of certain definite observations being set forth to the same absolute Time; but it would in like matters much shorten such operations if once for all a Normal Time were established, and it was not necessary on each particular occasion to make special arrangements on the point. It may appear paradoxical to say that of all sciences, astronomy, in despite of its vocation closely

to establish precision of time and to define motion in given periods, least of all requires such an accord. The explanation lies in the fact that astronomers, besides being accustomed to reduce to a common measure of Time, different places and the different observations made, are always in the position more easily so to reduce such observations than the representatives of other sciences, who have to deal only occasionally with Time and matters of Longitude. It must not, however, fail to be recognized that also for astronomy, benefit would arrive if the astronomers scattered over the earth's surface would make it a law among themselves for certain observations in the matter of Time to be referred to one and the same Meridian.

Applied to navigation, as can be well understood, the question enters into practical life. But the navigator, like the astronomer, has continually to consider the principle of difference of Time, and hence a law relative to the Unification of Time notation is of less relative significance to him. Whereas in other respects uniformity in the delineation of geographical Longitudes upon sea charts, and in the register of geographical sites, would be of substantial use, as well for the safety of navigation as for convenience in calculation.

In the matter of telegraphs it would principally be their administration which would derive advantages from one Time notation for the whole world. If despatches be solely sent as desired, according to Local or to Normal Time described, so sharp control can scarcely be exercised over delays or other hindrances, without repeated inquiries to and fro. By the general application of Universal Time, difficulties in this respect would be reduced considerably. Thus also the great body of the public would be a gainer, for then everybody would be in the position to know with certainty when the despatch in question was delivered; a circumstance which may be of the greatest importance in many cases, as well in commercial relations as in many other questions of civic life.

With regard to railway-communication, it is possible to introduce Standard Time to be observed within the territory of a single country, or to groups of countries bound together by close relations, by which the administration of the lines, and the movements of trains may be regulated; while with regard to the public, the Time to be exhibited can still adhere to the Time by which every day life is regulated, be it Local or Standard Time. Such has already been the case for some time in many countries, and has undoubtedly been attended with great advantages to the interior channels of communication. Thus with us in Russia, an ordinance has been in operation for some time, by virtue of which the movements upon all railways should be governed by Pultowa Time, and on some lines, at least, it is in force. On other lines which have been constructed at a later date, this ordinance has been departed from, and in different ways the movement has been regulated by the local Time of one of the

two termini, or by the Time of some point lying intermediate. This want of conformity with us, as it appears, hitherto has not brought to light any special consequences by which injury has resulted: possibly with this exception, that occasional stoppages have arisen from the irregularity of the trains, as for instance, the transport of freight can bear witness. But that through this want of conformity of Time, the more likely danger of collisions has not more frequently happened, is indeed to be ascribed to the fact that our railway communication with other countries has only been partially developed, and the rate of speed of the trains, in spite of the greater lengths of single lines, is considerably less than elsewhere. Under these circumstances, it appears by the free use of the telegraph, collisions are avoided. But it is to be expected that with time, this constant untrustworthy expedient will not be sufficient, and that, as a consequence, owing to an increased communication, a decided and identical Time will be again made obligatory on the administration of all Russian railways.

Until lately a similar condition of things existed in North America with regard to the notation of Time on Railways. There, as with us, Railway Time was not governed by a common binding law. But the administration of single lines accepted, for the movement of trains generally, the origin of Normal Time, which in the easiest manner they could obtain from one of the observatories in the neighbourhood of the line. The complications which arose from this want of conformity in the enormous increase of railway communication, furnished the starting point to the extended effort which was made last year in North America on behalf of a strict wide-spread regulation on the subject of Time Notation established by the Railway administrations, not simply within the territory of the United States but where possible over the entire continent. Had the matter alone applied to the United States it would have been easy possibly to establish the desired good understanding either through a resolution of Congress or by a convention of the directors of the several lines. But, at the same time, the desire arose to include in the same strict arrangement the railways of neighbouring states, which equally in the matter of Time Notation were subjected to local enactments and incidental changes. This desired arrangement could only be obtained by international agreement. Such an agreement obtained by means of an international conference or congress became so much the more desirable when this beneficial result, principally sought after for the new continent, could equally extend its good results to all the civilized states of the earth: and at the same time it was to be expected that resolutions passed in such a meeting would be held to be binding on each individual country with an enhanced degree of force.

It is especially during the last ten years that those persons who in North America have taken interest in such questions have

directed their efforts towards the accomplishment of an international convention of this character which, at the same time, should form some determination with regard to the First Meridian generally to be accepted. A point which, if with regard to the immediate object of the congress is not indispensably necessary, has, from its near connection with it, become included in its consideration. Among such as these, pre-eminent mention must be made of Mr. Sandford Fleming, sometime Chief Engineer of the main lines of railway in Canada, at present Chancellor of Queen's University, Kingston. It is through his indefatigable personal efforts and writings that influential individuals and scientific and practical societies and institutes in America as in Europe have been gained to the cause. Especially the Canadian Institute in Toronto, the American Society of Civil Engineers, and the American Metrological Society of New York, who in common busied themselves with the question and appointed special commissions to consider the subject, and passed resolutions for the further prosecution of the business. The result of these efforts was that the Government of the United States of North America in August, 1882, was induced through their diplomatic representatives at the Governments of all civilized countries to invite the latter to send delegates to an international conference to be held at Washington to consider the question.

It must be regarded as an important preparation to this conference, that scientific men in Europe had had an opportunity beforehand of exchanging their views on the subject under consideration, and were enabled from their own standpoint authoritatively to recommend certain resolutions which could count upon the support of their respective Governments. The initiative was taken by the Senate of the free city of Hamburg which proposed that the subject should be brought up at the Congress, summoned to meet in Rome in September, 1883, of European Astronomers and of men interested in Geodesy and in the division of measurement of the degree. The permanent Committee of the latter Society willingly accepted the proposition, and convened for this object a meeting of prominent scientific men, who, beside the immediate matter of the measurement of the degree, issued an invitation to other learned men to take part in the deliberations, from which a satisfactory opinion with regard to the Unification of Longitude and Time could be expected.

It was seen from the beginning that with regard to the important matter, the choice of a First Meridan, a marked majority would declare itself in favour of Greenwich, which, apart from all other considerations, sufficiently satisfactorily commended itself upon the ground that approximately nine-tenths of all the Sea Charts in use on sea voyages are constructed according to this Meridian, so that the common acceptance would be effected in the easiest manner, and would call

relatively for the slightest sacrifice from other countries taken collectively. In the mean time, it was by no means unknown that also other Meridians, namely, that of Paris and the Meridian distant from it 20° in round numbers, which it has been customary to describe as that of Ferro, had well-grounded claims to consideration. Astronomers claimed for the former, that of Paris, that the classic labours of Laplace, Bessel, Leverrier, Hansen and others had been based upon this Initial Meridian, which had thus been taken as their starting point on Astronomical Territory. It was urged with regard to the latter, that it was the object of constant reference in School Atlasses of Germany, Russia and other lands. On the other hand, with regard to Greenwich, besides the practical advantages already named, it could be especially claimed that by far the majority of geographical positions on the earth's surface, were principally established according to this Meridian; and that the Greenwich Observatory for more than two centuries having published continuous observations on the Moon's motion, and through manifold labours and investigations bearing on navigation, had rendered such service to geography and navigation, which no other institution could adduce, or even in any way approach.

Influenced by such considerations, it followed that at the Congress at Rome, the resolution in a certain manner was unanimously adopted to recommend for general acceptance as First Meridian that of Greenwich. Even the numerous French representatives, many of them persons of importance, did not oppose this step, but by abstaining from voting, contented themselves with this expression of sympathy, with the Meridian of Paris so acceptable to them. Likewise, some other resolutions bearing upon the subject were at the same time carried with such a large majority as almost to make the vote unanimous: viz., that the Longitudes should be numbered from Greenwich to the East around the whole earth to 360°; that the Universal Time to be introduced, should be Mean Solar Time, taken from the First Meridian, and that the notation of the latter should be without division of the day in two halves, but carried on to 24 hours. A more lively discussion was created by the question, whether the numeration of Universal Time should begin at Greenwich, mid-day or mid-night, was decided in favour of the former. During the consideration of this resolution, the fact came into strong prominence, that as the present custom of astronomers, and to some extent of navigators, is to reckon the date from noon, the arrangement of details and the difficulties which a departure from this custom would carry with it, would be felt equally by astronomical chronology, as by the calculator of the Ephemerides. In conclusion, two resolutions were accepted by the Congress of Rome, the purport of which was in no way connected with its special purpose. One of these set forth, that it was desirable for certain ends, especially for geodesy, that the decimal notation should be introduced into the circle; and the wish was

expressed by others present, that the Greenwich Meridian having been accepted as First Meridian, might be looked upon by the British Government as an equivalent, which might lead them to accede to the Metre Convention of 1875. The last result did actually take place last year.

In the meantime the Government of the United States had received replies from the greater number of other Governments, expressing their readiness to send delegates to the proposed International Conference; and after that it had been established in Rome, that unanimity in relation to the determination of a First Meridian was proportionably easy of attainment, the Government of the United States sent invitations to all civilized States to attend a Congress which should be held at Washington October 1, 1884.

In this place (Russia) as a further preparation for the Conference, on the proposal of the Geographical Society, a Special Commission was appointed, consisting of representatives of the War and Marine Departments, of the Imperial Academy of Sciences, and the Geographical Society, in order to examine into the question in connection with the main line of discussion, to signify the persons to be delegated to Washington on the part of Russia, and to submit and draw up instructions for their guidance. It may here be incidentally mentioned that with regard to these instructions, the purport of which was set forth in a short paper written by one of the Commission, Lieutenant-Colonel Rylke, that in all essential points they fully agree with the resolutions passed at Washington at a later date. The following delegates to Washington were recommended by the Commission and therefore named by the Government:—1. The Russian Ambassador to the United States, C. von Struve, who through his extended travels and his geographical labours in Central Asia, possesses at the same time special qualities for the scientific discussions which might be looked for. 2. Chief of Caucasian Survey, General Major Stebnitzki, well known through his not less comprehensive as carefully executed geodetic labours, and for the marked scientific spirit with which they have been carried out. 3. Herr Kologruvoff, member of the Council of Routes and Communications.

Other countries were represented at the Washington Conference as follows:—United States, 5 delegates; Great Britain, 4; Spain, 3; Germany, France, Hawaii, Mexico and Chili, 2 each. The remaining States had one delegate. The *diplomates* accredited to the Government of the United States for the most part also assumed similar duties; for the prominent questions came before them for consideration not so much in a scientific point of view as from the standpoint of general use and international communication. But accurate science was also pre-eminently represented at the Congress. Without regard to the many experienced men prominent from their geodetic and hydrographic labours, who with right may claim to be held as efficient

representatives of the interests of science, the Congress counted in its midst as delegates the world-renowned Director of the Cambridge Observatory, Mr. Adams; the Associate of the Academy of Sciences at Paris, M. Janssen; Mr. L. M. Rutherford, of New York, of acknowledged merit by his labours in the territory of Astrophysics; the scientific representative of the U. S. Signal Office, Mr. Cleveland Abbe. Besides as it opportunely happened that many scientific men were in Washington domiciled, or accidentally there for a time, the Congress invited them to express their opinion on the matters under consideration; the head of the American Nautical Almanac, Mr. S. Newcomb, renowned by his genial and comprehensive labours in the field of astronomy; the Director of the Coast Survey, Mr. Hilgard; the celebrated natural philosopher, Sir William Thompson, and the Director of the Carlsruhe Observatory, Dr. Valentiner.

In the whole, 25 countries were represented at the conference. It was resolved that voting would be simply by states, with equal authority without regard to the number of representatives, or the stand-point of national development [*Culturstand*], the extent of territory, or the amount of population of each country. There were many important points of consideration differing in character, which pointed towards this mode of proceeding. Indeed, as it turned out, a procedure essentially different apparently would have led to the same result, as the proceedings, as they are set forth in the Protocol, testify. In all important matters, Great Britain and the United States went hand in hand with Russia, and this accord on the part of the representatives of those countries, which, at least with regard to extent of territory, were the most affected by the questions under discussion, perceptibly exercised great influence on the result of the vote.

As the conference on the 1st October, 1884, met in the Diplomatic Hall of the Department of State, in Washington, they immediately selected as President the Honourable Admiral Rogers, of the American Navy. The prudence, skill, and impartiality with which he presided over the proceedings are sufficiently established in the record of the Protocol. Lieut.-General Strachey, of the English, M. Janssen, of the French, Dr. Cruls, of the Brazilian Legation, were appointed Secretaries.

The conference held eight sittings between October 1st and November 1st; some of which were prolonged for many hours. After several delegates, among them those of Russia, had made the declaration that they were unable to consider the resolutions of the conference as binding on the countries which they represented, and that they could only pledge themselves to recommend to their respective governments, such resolutions as they might vote for, the determination was then taken as to organization, and the mode of conducting the business of the congress. With regard to the essential

business of the congress, after a debate, in some respects often animated, the following eight resolutions were passed :—

I.—That it is the opinion of this congress that it is desirable to adopt a single Prime Meridian for all nations, in place of the multiplicity of initial Meridians which now exist.—[*Unanimously adopted.*]

II.—That the conference proposes to the governments here represented the adoption of the Meridian passing through the centre of the transit instrument at the Observatory at Greenwich, as the Initial Meridian for Longitude.—[*Ayes, 22 ; noes, 1 ; abstaining, 2.*]

III.—That from this Meridian Longitude shall be counted in two directions up to 180 degrees, East Longitude being *plus* and West Longitude *minus*.—[*Ayes, 14* ; *noes, 5 ; abstaining 1.*]

IV.—That the Conference proposes the adoption of a Universal day for all purposes for which it may be found convenient, and which shall not interfere with the use of local or other Standard Time where desirable. —[*Ayes, 23 ; abstaining, 2.*]

V.—That this Universal day is to be a mean Solar day ; is to begin for all the world at the moment of mean midnight of the initial meridian, coinciding with the beginning of the civil day and date of that Meridian, and is to be counted from zero up to twenty-four hours.— [*Ayes, 15 ; noes, 2 ; abstaining, 7.*]

VI.—That the Conference expresses the hope that as soon as may be practicable the astronomical and nautical days will be arranged everywhere to begin at mean midnight.—*Carried without division.*

VII.—That the Conference expresses the hope that the technical studies designed to regulate and extend the application of the decimal system to the division of Angular Space and of Time shall be resumed so as to permit the extension of this application to all cases in which it presents real advantages.—*Ayes, 21* ; *abstaining, 3.*]

VIII.—That a copy of the Resolutions passed by this Conference shall be communicated to the Government of the United States of America, at whose instance and within whose territory the Conference has been convened.—[*Adopted unanimously.*]

The first Resolution was manifestly purely formal. It merely stated the end for which the Congress was called together, somewhat more fully than had been done in the invitation. The last resolution is also of the same character, a formal conclusion of the matters under consideration, as the results looked for will lead to further diplomatic proceeding with regard to the resolutions adopted.

We beg leave to enter here into some further discussion with regard to the other six resolutions.

During the discussion on the choice of the First Meridian the French delegates made the proposition that in place of passing through a specified observatory, the choice should, if possible, be made of an entirely neutral Meridian. Plausible as this proposition appears at the first glance to set aside all national jealousies, so the very definition of what was meant by an absolute neutral Meridian, at once hit upon serious difficulties. Moreover the proposition appeared even in a more unfavourable light upon closer

consideration of the conditions necessary to satisfy a neutral Meridian. For to be of importance as a First Meridian among others, and in order to admit of no ambiguity it must contain in itself a departure from the principle of neutrality by the determination of its position of Longitude through an observatory in the neighbourhood to be designated authoritatively.

The idea of selection on grounds of neutrality was therefore set aside by a great majority. The remark of M. Janssen, on the occasion of the discussion of this subject must be recognized as most just. Namely, that the Meridian of Ferro, introduced at the commencement of the 18th century, through De L'Isle, and subsequently brought into common use, lying 20° to the west of that of Paris, by that fact furnished a marked objection to its selection as the common First Meridian, for from this circumstance it had become purely a French Meridian, and thus, to the great disadvantage of all geography, the Meridian of Ferro had lost its international or neutral character.

After the theory of a neutral Meridian was set aside, the grounds on which Greenwich as the starting point of longitude was advocated, came into prominence with their fullest force, and the choice of it as the initial Meridian, followed almost with unanimity, France and Brazil as advocates of the neutrality principle, abstained from voting, and only the representative of San Domingo, M. de Galvan, voted positively against Greenwich. The latter, however, added that his negative vote must only be taken as an expression of his sympathy with the principle of neutrality.

The three succeeding Resolutions, the numbering of Longitudes with different signs, East and West from Greenwich; the acceptance of an Universal Day for special purposes; and the accord of this Universal Day with the Time Reckoning of civil life under the First Meridian, were in their essence internally connected one with the other. The discussion in the Conference accordingly was directed at the same time equally to the three Resolutions, although the vote upon them was given on each proposition separately. It is a matter worthy of attention, that the second, which set forth the main principle, was the only one which obtained an almost unanimous vote, while for the two others many countries abstained from voting, some of the smaller territories even voting negatively. An explanation of this manifestation is found in the fact that a great number of the Delegates were not provided with special instructions in regard to particular questions, but had only received as a rule of conduct that they should hold to the Resolutions of the Congress at Rome, which in these two particular points had decided in the opposite direction. These Delegates evidently did not feel themselves at liberty to depart from what had been laid down at Rome, even when their own personal views in the course of the discussions at Washington rather inclined them to the prevailing direction of the Resolutions there brought forward,

on the ground of common utility and their conformability to the requirements of the case.

In Rome, namely, it was proposed that the Longitudes departing from the custom observed, should be numbered around the whole earth from West to East, and this proposition was there accepted without further discussion; so that nothing definite is known concerning the reasons on which this resolution was founded. In Washington, on the other hand, this question was fully discussed. It was there expressly and forcibly urged that the resolution adopted at Rome was fraught with mischief for Cartography, that a departure from the numbering in use $\pm$ 180° from the Initial Meridian, in no way offered any scientific advantage, and that the numbering of Longitude to 360°—the 24 hours of the ultimately asked-for change of Civic Time into proposed Universal Time—from want of practice, would cause great difficulties and complications. It resulted accordingly that the maintenance of the system in use, found no special effective opposition from any side.

It was different with regard to the question whether Universal Time should commence with Greenwich, mid-day or mid-night. This question in Rome, as in Washington, was discussed in detail. At Rome the preference was given to mid-day, as thereby the interests of astronomers and navigators were especially brought into prominence. At Washington, on the other hand, the seamen who were present at the Congress maintained that the new principle was of no actual importance for men of their calling, a view which was held also by the Russian naval men.

It was also mentioned that already in the United States Marine it was a common practice as in ordinary civic life to count the commencement of the day from midnight. Consequently the argument came with greater weight in the Washington Congress that the translation of the commencement of the Universal Day to Greenwich midday would cause considerable disturbance to Trade and Commerce in the most populous territories of the world; while at these places during the most important business hours, in the period approaching midday, a double set of dates must come into use. In the presence of an argument of this character, the interests of the astronomer, which alone must suffer from the determination must naturally be placed in the background. So, as above remarked, the resolution to take midnight at Greenwich as the commencent of the Universal Day was carried by a two-thirds majority, 7 countries abstaining from voting, 2 voting negatively.

During the discussions on the Universal day an opportunity was given to Mr. Sandford Fleming to submit his generally well-known opinions as to the form in which the common acceptance of Universal Time can take the place of the ordinary time affecting civil life which in each particular place depends on the rising and setting of the sun.

These opinions have taken root in North America. For about a year, especially by the impulse given by the administrations of railways, the United States and Canada, not through force of law, but by common arrangement of those interested, have been divided into six divisions, within the boundaries of which the time notation of ordinary life, although in a strict sense answering only to the middle Longitude of the Time-division, is taken as a constant, which in the successive time-divisions each differs from the other a full hour. According to the communications of the delegate of the United States, Mr. W. F. Allen, this arrangement has been accepted by not less than 85 *per cent.* of the cities of the United States containing 10,000 inhabitants, and 80 per cent. of the administrations of railways affected. For this period no practical difficulties have been reported even in those places where the true Time of the place differs half an hour from the Division-time introduced. But that some necessary difficulties must be experienced by this arrangement in actual civic life is proved by the observation that within these Time-divisions where at the boundaries there is a clear round hour where one can differ from the other, certain every-day occupations, for example, the hours of labour of the day-labourer with regard to the same use of day light must be established in a different manner with regard to each other, according as the spot under consideration lies to the east or western boundary of the Division. How this mode of proceeding is regarded by the inhabitants of the prairie-land the report in no way informs us. It would, however, be a matter of surprise if serious complications did not arise. For instance, village communities, which are only a couple of kilometres apart [1 2-5th miles] or are yet nearer neighbours, must make use of Time notations which differ an entire hour. So it forces itself on our attention that in a community of countries of which Europe consists, in which individual states, apart from their geographical position, gravitate to one side more than the other in their commercial, industrial, or political relationship, that by the adoption of similar proceedings they would be subjected to embarrassments perfectly unsupportable. Nevertheless, the attempt made in America is full of interest and instruction, and by the favourable result which it is said the first year has effected, it becomes a matter for serious reflection that this method of Time reckoning has been fully naturalized in the United States, and perhaps will be accepted by other countries. The same principle is also applied and has also been long in use in Great Britain, of which the isolated position and scarcely an extent of 30 minutes in longitude have greatly facilitated its introduction. In any case the further extension of the principle is yet in the category of experiments, and for this reason the Washington Conference did not recognize that it was in a position to offer a resolution on the subject, or even to enter into its discussion in detail.

It might be remarked that the method adopted for the period of dating the Universal Day accepted by the Conference, would not

interfere with the system followed by astronomers. That astronomers would quietly remain in their old customs without grieving themselves as to the arrangement of a matter indifferent to them. At a period when everything tends to the simplification of reciprocal relationships, it must appear to us desirable that the numeration of date differing from the rest of the world, must also be abandoned by astronomers, and indeed for the greater reason, that in modern times the mission of many observatories is not simply to subserve scientific purposes, but also to unite with them matters of practical utility. The latter are thrown into active communication with the outer world, which, with a double notation of the date, would be much prejudiced. The sixth resolution of the Washington congress, with regard to Time Notation, unanimously voted, which expresses the hope that as soon as it appear practicable to carry out the principle, astronomers and navigators should introduce into their practice the principle of dating the day from midnight, carries this view. The Russian delegates joined in this strongly felt hope; although, in the instructions given to them, this question had not been mooted.

The seventh resolution, submitted according to the wish of Herr Janssen [recommendation, that the studies over the Decimal Division of Angles and Time should be resumed] intrinsically stands in no relationship with the propositions which were submitted to the Washington conference, and was from the first declared by the President as not coming within its powers. But a majority of those present, out of regard to the French delegates, and out of consideration for the indirect form in which the resolution was set forth, declared that it was permissible to vote upon it. Accordingly, without further discussion, it was almost unanimously accepted.

It is now asked by everybody, whether there is any prospect that the Washington Resolutions will come into operation, and by what means that result may be attained? In fact they are to be regarded principally as an authoritive expression of men enjoying public confidence in the different countries whose Governments in no way have pledged themselves unconditionally to accept the Resolutions and to give them the force of law. It, however, can be foreseen, that sustained by these important expressions of opinion, the logic of facts, and the necessity for the realization of these resolutions will possibly in no distant time lead to that result. Therefore, naturally it comes to be pre-eminently a duty for those who in the different countries are in the position to exercise influence in this direction, to make this influence felt in the sphere of their labours.

It may be considered as certain that the use of the Greenwich Meridian for Cartography and the numeration of Longitude will shortly, and without difficulties being created, be introduced into all countries. In this matter, the organs of the Governments of the three most widely extended countries, Russia, Great Britain, and the

United States of North America, have come to an understanding, and in other countries, such as Germany and Italy, the like result may be looked for, as the same Meridian is already there legally introduced in the preparation of the Hydrographic Charts. Possibly France, out of national feeling, may for some time appear as holding back. Eventually, however, it may be looked for, that regard for the common good, and for the actual interests of its own navigation, may cause the Government of that country to make the unification complete. We may, therefore, regard the chief object of the Washington Conference, namely, the establishment of the First Meridian, from which all the remaining questions are more or less natural consequences, as satisfactorily solved.

Possibly the introduction of Universal Time may experience greater difficulties in the administration of commercial institutions, as this innovation will act upon a numerous class of people, and awaken new ideas on questions with which they have had little occasion to make themselves familiar. In the meantime, according to the opinion of men capable of appreciating these difficulties, at least in Russia, where there is great extent in Longitude, besides where the ideas over the differences of Time Notation are more complicated than elsewhere, they are less important than at the first glance they would appear to be. It is to be expected that at the present time the constantly repeated Congresses on Railway, Post and Telegraph Administration will soon occupy themselves with this matter, and sustained by the authority of the Washington Congress, will call into practice the Resolutions in this respect which were passed there.

Much earnest reflection, on the other hand, must be given to the desire expressed at the meeting, that Astronomical Time Reckoning should be brought in accord with the commencement of the day in civil life.

In this matter astronomers have not simply to abandon a custom of long standing, and consequently to make conditional changes of practice established for many years, but at the same time astronomical chronology is disturbed, which it is easily understood, must exercise a marked effect on the comprehension of all problems bearing upon motion. Without doubt, the astronomer must make a great sacrifice for the fulfilment of this desire; but in reality this sacrifice is not greater than that entailed on our forefathers, when they passed from the Julian to the Gregorian Notation of Time, or when they altered the commencement of the year : a sacrifice of convenience, by which we yet suffer when it becomes necessary to refer to phenomena of remote dates. At this period we must the less stand in fear of a like sacrifice, when by such means an acknowledged existing non-accord between science and ordinary life can be set aside : a non-accord which it is true in individual cases does not press heavily on the astronomer, but which is a constant source of inconvenience for non-professional

astronomers, who are desirous of making use of astronomical information. And in such respect this sacrifice ceases so to be considered and is transformed into an act of public utility with regard to all astronomical details which stand in clear relationship with the outer world, in which almost daily conflicts come to the surface between the different designations of dates. Conflicts, among others, which even are injurious to astronomical labours in such observatories, where observations are continually adjusted to the day.

Great Britain, apparently, has the greatest reason to be satisfied with the Washington Resolutions, for, in her case, there is the greatest accomplishment of her wishes, with a minimum of discomfort and sacrifice. The cartography of the whole Kingdom and its Colonies is already based on the Meridian of Greenwich, and the notation of time in commercial relations in civil life in England and Scotland is determined by mean Greenwich Time, which hereafter also will be recognized as Universal Time. This preference is a tribute of gratitude for the immense expenditure of time and labour which for more than two centuries English astronomers, navigators and geographers have continuously bestowed on geography and navigation, far exceeding all that in this respect has been done by all other countries. But, on the other hand, this preference has imposed upon England the moral obligation to exert herself to carry out earnestly the wishes expressed at the Washington Conference, namely, the establishment of accord between ordinary Astronomical and Nautical Time notation. It is deserving of comment that this obligation is recognized and that the present Astronomer Royal, Mr. H. M. Christie, already has taken the first step in this direction. Since the 1st of January of this year, the date of observations, and chiefly in the interior economy of the Greenwich Observatory, the date will be set forth equally for the mean Greenwich Time hitherto used and also for Universal Time. In all the publications issued from this Observatory the old mode of notation will be maintained until it appear advisable to use exclusively Universal Time. At the same time Mr. Christie has given instructions that the great dial which stands at the entrance to Greenwich Observatory, which in a manner regulates the time for the whole of England, being continually brought into requisition by the public, henceforth will show Universal Time from midnight to the 24 succeeding hours. It must appear not less important that the directors of the Nautical Almanac have in deliberation whether and when the corresponding changes in its arrangement with regard to all other disseminated Ephermerides are to commence in order to make them accord with the Date-notation of Universal Time. Possibly it might be arranged to come to pass for the year 1890.

While the Directors of the Pultowa Observatory make their full acknowledgment to the Astronomer Royal for this precedent which

has been established, so are they ready to follow the example ; and this fact leads us the more to expect that also this course will be adopted by the Washington Naval Observatory, as in the American Marine the Date-notation from midnight has been already accepted. It is only in the matter of the period, when the Date-notation, according to Universal Time, should be introduced into the publications of the observatories, that we feel inclined to recommend, that there should be delay until in this respect the most perfect possible understanding be attained by all astronomers, in order to avoid the much more critical disturbance in astronomical chronology which would arise, if the transition to the new Date-notation was not equally followed on all sides. We are desirous, accordingly, of suggesting a suitable time-point for the commencement of the year, for which the Nautical Almanac would inaugurate the changes corresponding to the requirements named. The latter has before been said could come to pass in the year 1890. We would, however, ourselves prefer the change to take place, in the first instance, with the change of the century. Until that date, it would probably be the simultaneous proceeding of all astronomers, with general consent to look forward to this period of transition, and it would more easily stamp itself on the memory of all who hereafter would be busied in investigations, in which exact chronology plays a part.

In conclusion, a circumstance may be mentioned which will be of interest to a wider circle of the public. In the Washington Conference it is true every resolution was avoided which could directly be considered as an influence on ordinary Time reckoning. But nevertheless an opportunity was offered to the Russian delegates to submit the principle and to recommend it for consideration that it certainly was desirable to introduce into ordinary Time-notation, as it is it would be also acceptable for Universal Time, to set aside the exceedingly embarrassing division of the day in two halves of 12 similarly-named hours, and in their place again introduce a continuous notation to 24 as has for some time already taken place in different countries. This idea has visibly fallen on ground well prepared to receive it, and already there is every prospect that the fruit will ripen. The instructions of the Astronomer Royal, which bear close relations to Universal Time, through the exhibition of the great clock of Greenwich Observatory divided into 24 hours in order to accustom the public of that country to the continuous hour notation for the entire day, has been greeted in the intelligent circles of England as it appears with enthusiasm as the simpler means of avoiding the so frequent matter of uncertainty whether forenoon or afternoon be meant. It is, perhaps, not quite easy to explain with any correctness, from what date and upon what grounds the present division of the day at noon into two equal parts is followed : especially as the ancient practice (for example with the Hebrews in antiquity) teaches us that the numbering the hours in one series practically offers no difficulty. At all events a

division of the day into day and night by Nature is grounded on an equal duration of the hour, as it continued with the Romans. But the division of the same into equal parts by the passage of the sun through the line of mid-day is sustained by no natural principle which can stand the test of proof. The very name mid-day testifies not to the division of the same into two parts, but only the middle of an uninterrupted whole. It appears to us not entirely improbable that the division of the day into two parts of the like number, specification and duration of hours, has especially found a point of support in the theory that in the infancy of the art of clock-making, the technical means were wanting to the clock-maker to show upon the dial-plate sufficiently and satisfactorily divided one from the other, all the 24 different hours; especially with watches. This supposition is strengthened by the circumstance that in some countries, namely in Italy and Bohemia, even to the latest times, clocks on the towers, of which the larger size permitted all the 24 hours to be shown on their dial plate, had them so marked and with works adapted to the movement. In the present condition of the art the cause for shortening the notation of the hours has entirely passed away, and at the same time the possibility presents itself of getting rid of the inconvenience which was called forth by it. If this end be attained in coming time, the Washington Conference from the impulse which it has so far given to it, has rendered a great service to all mankind.

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NOTES.

1.—The First Series has for title, "The Canadian Journal: a Repertory of Industry, Science and Art; and a Record of the Proceedings of the Canadian Institute." The Second series has for title, "The Canadian Journal of Science, Literature, and History." The title of the Third Series is, "Proceedings of the Canadian Institute." Parts 1 & 2, Third Series, are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

2.—By inadvertence, No. 85 (November, 1873) of the "Canadian Journal," 2nd Series (Vol. XIV.) immediately follows No. 79. There is, however, no *lacuna* between these two numbers, as is shown by the fact that the paging is consecutive.

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PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

SESSION 1884–'85.

NINTH ORDINARY MEETING.

The Ninth Ordinary meeting of the Session 1884-'85, was held on Saturday, January 10th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following gentlemen were elected members of the Institute :

George Ritchie, B.A., B.Sc.; Charles Ridout, Esq.; Alexander Macfarlane, M.A. D. Sc., F.R.S.E.

The following list of donations and exchanges received since last meeting was read :

I.—CANADA.

1. Report of Progress, 1874-75. From the Geological Survey of Canada.
2. Figures and Descriptions of Canadian Organic Remains. Decade II. Graptolites of the Quebec Group, by James Hall, 1865.
3. Atlas of Maps and Sections to Report of Progress from the Commencement to 1863.
4. Geology of Canada. Palaeozoic Fossils, Vol. I., by E. Billings.
5. Palaeozoic Fossils, Vol. II., Part I., by E. Billings.
6. Palaeozic Fossils, Vol. III., Part I., by J. F. Whiteaves.
7. Mesozoic Fossils, Vol. I., Part I.
   Mesozoic Fossils, Vol. I., Part III.
8. Report on the Polyzoa of the Queen Charlotte Islands, by Rev. Thomas Hincks.
9. The Fossil Plants of the Devonian and Upper Silurian Formations of Canada, by Sir J. W. Dawson.
10. Report of the Fossil Plants of the Lower Carboniferous and Millstone Grit Formation of Canada, by Sir J. W. Dawson.

11. The Fossil Plants of the Erian (Devonian) and Upper Silurian Formations of Canada, by Sir J. W. Dawson, Part II.
12. Preliminary Note on the Geology of the Bow and Belly River Districts, N. W. Territory, by George M. Dawson, 1882.
13. Descriptive Sketch of the Physical Geography and Geology of the Dominion of Canada, by Alfred R. C. Selwyn and G. M. Dawson, 1884.
14. Comparative Vocabularies of the Indian Tribes of British Columbia, by W. Fraser Tolmie and George M. Dawson, 1884.
15. Map of the Dominion of Canada, Geologically Coloured, from Survey, made by the Geological Corps, from 1842-1882
16. The Canadian Entomologist, Vol. XVI., No. 11.

II.—UNITED STATES EXCHANGES.

1. Science, Vol. IV., Nos. 98 and 99, Dec. 19 and 26, 1884.
2. Proceedings of the Academy of Natural Sciences of Philadelphia, Part II., May to October, 1884.
3. An Account of the Discovery of a Mastodon's Remains in Northborough, Worcester County, Mass., by Franklin P. Rice.
4. Bulletins of the Minnesota Academy of Natural Sciences, Vol. II., No. 4.
5. Proceedings of the Boston Society of Natural History, Vol. XXII., Part IV., Oct. 1883, Dec. 1883.
6. The American Journal of Science for January, 1885.
7. Journal of the Franklin Institute, January, 1885.

III.—BRITISH EXCHANGES.

1. Proceedings of the Royal Geographical Society, Vol. VI., No. 12, December, 1884.
2. Archaeologia Aeliana, Vol. X., No. 2, from the Society of Antiquaries of Newcastle upon Tyne.
3. Monthly Notices of the Royal Astronomical Society, Vol. XLV., No. 1, November, 1884.
4. Journal of the Royal Microscopical Society, Series II., Vol. IV., Part VI., December, 1884.
5. Journal of the Transactions of the Victoria Institute, Vol. XVIII., No. 71.

IV.—BRITISH COLONIES (EXCLUSIVE OF CANADA).

1. Proceedings of the Asiatic Society of Bengal, Nos. 8 and 9, August and September, 1884.
2. Records of the Geological Survey of India, Vol. XVII., Part IV., 1884, From the Colonial Museum, Wellington, New Zealand.
3. Geological Reports, 1879-80, 1881, 1882, 1883, 1884.
4. Fossil Corals.
5. Museum and Laboratory Reports, 8-18.
6. Fishes of New Zealand.
7. Meteorological Reports, 1873, 1875, 1877, 1880, 1883.
8. Tertiary Mollusca.
9. Manual of New Zealand Mollusca.
10. Manual of New Zealand Grasses.
11. Manual of New Zealand Coleoptera, Parts I. and II.

12. Diptera.
13. Biological Exercises, Parts I. and II.
14. Handbook of New Zealand.
15. Catalogue of International Exhibition, 1879 (New Zealand Court).

V.—FOREIGN.

1. Correspondenz-Blatt der deutschen Gesellschaft für Authropologie, Ethnologie and Urgeschichte, XV. Jahrgang, No. 10, October, 1884.
2. Tesis leida en el Examen Profesional de Ingeniero Geografe, per Joaquin de Mendezabal Tamborrel.

Total 66 numbers.

Dr. Macfarlane read a paper entitled :

NOTATION FOR PHYSICAL UNITS.

The late Professor Clerk-Maxwell in his treatise on Heat says, "Every quantity is expressed by a phrase consisting of two components, one of these being the name of a number and the other the name of a thing of the same kind as the quantity to be expressed, but of a certain magnitude agreed on among men as a standard or unit." Heat, p. 75. When we apply this analysis to the expressions of quantities, we find that in many cases there is no notation for the latter component—the unit. The general expression for a velocity is v; what does this single letter denote? It must be viewed either as denoting both components, or else as denoting the numerical phrase and leaving the unit to be understood. When a particular velocity is expressed, both components are expressed, as for instance 123 feet per second. Now if v is the general symbol corresponding to 123, what is the general expression corresponding to *feet per second?* But further it is only in the simplest cases that we have a notation for the special unit; and the consequence is that in the specification of quantities, as in tables of constants, there is considerable trouble in ascertaining from the context what special unit is understood.

If we look into text-books on arithmetic and examine the rules given for the application of arithmetic, such as the Rule of Three, or the unitary method, we find that the difficulty which is met but not overcome, is to express the dependence of one quantity upon one or more other quantities. It may be objected that the *formula* meets the difficulty. Only partly, I reply, for the formula expresses only the numerical component, not the unit component. It is well known

that a formula leaves much to be understood or to be discovered about the units involved. Besides, it is difficult to an elementary arithmetician to understand it so well as to be able to use it with intelligence.

These defects appear to me to be due to the want of a systematic notation for units. By a notation for a unit I mean something different from a name; the latter merely designates, the former shows the dependence of the unit upon more fundamental units. The chemical notation for a substance expresses the manner in which the substance is made up of the elementary substances; while its name, however derived, serves merely as a distinguishing mark. And just as the chemical notation for a substance may be used as a name for the substance, so the notation for a physical unit may serve as a name for that unit.

In a work, about to be published, on Physical Arithmetic, I make use of a notation for units, and I show how the notation can be applied in the reasoning out of problems. The analysis of a quantity upon which I proceed is threefold, namely, numerical value, unit, and, when necessary, descriptive phrase. For example, the letter x as used in geometry, denotes not only a number and a unit, but also a particular direction.

The progress of physical science has made us familiar with the idea of a system of units, and as specimens we have the centimetre-gramme-second system, and the foot-pound-second system. There is however no systematic notation for the units whether of the general system or of the particular systems. The notation which I propose is the logical extension of existing notation, and is in harmony with both the English language and the established notation of mathematics. The nature of the notation will be seen from the table appended.

We require letters to denote the fundamental units of length, time, mass, and temperature. Let L denote any unit of length, T any unit of time, M any unit of mass, and θ any unit of temperature. They are the units corresponding to the numerical values l, t, m, θ The letters S, V, F, W, P, Q in the same manner stand for names.

When a unit depends directly upon two units, as S upon L long and L broad, the relation of the independent units is expressed by means of *by*. When a unit depends directly upon one unit and

inversely upon another unit, the relation of the two independent units is expressed by *per ;* for instance, the unit of velocity is expressed by L per T. The words *by* and *per* correspond to the signs × and ÷, or rather now used by scientific men instead of the cumbrous ÷.

Sometimes, as in the unit for conductivity, a bracket is required after *per* (just as in the case of a numerical expression a bracket is sometimes required after —), to show that the sign attaches to the whole of the unit included within the bracket. And as – followed by – is equivalent to +, so *per* followed by *per* is equivalent to *by*.

A rate of exchange may be expressed either by means of *per*, or by means of =. For example, 4·85 dollars per pound, and 4·85 dollars = pound. Here the sign = is read 'for every.' In the same way a velocity may be written v L per T, or v L = T. Again a conductivity can be expressed as

$$k\ H \text{ per } T \text{ per } S \text{ per } (\theta \text{ per } L),$$
$$\text{or, } k\ H \text{ per } T \text{ per } S = \theta \text{ per } L.$$

A velocity has only one reciprocal, namely

$$1/v\ T \text{ per } L;$$

but a conductivity has several, as

$$1/k\ \theta \text{ per } L = H \text{ per } T \text{ per } S,$$
$$\text{and } 1/k\ H \text{ per } T \text{ per } \theta = S \text{ per } L.$$

Equations of the kind which occur in exchange have not, so far as I know, been adequately treated. They are more properly termed equivalences. In ordinary equations the units of the two sides are identical ; in equivalences they are either different in nature or different in description. The equations of exchange are combined by what is called the *Chain Rule ;* and in the work referred to I show that a development of that rule is the method corresponding to the analytical expression of a quantity. For example, to express a speed of 60 miles per hour in terms of kilometres per second :

1	kilometre	= 1,000 metres.
1	metre	= 39.37 inches.
36	inches	= yard.
1,760	yards	= mile.
60	miles	= hour.
1	hour	= 3,600 seconds.

$$\therefore \frac{36 \times 176 \times 6}{3937 \times 360} \text{ kilometres} = \text{sec.}$$

i.e. ·0268 kilometres per second.

The C. G. S. system is obtained by substituting *centimetre* for L, *second* for T, and *gramme* for M. For θ the *degree centigrade* is used. Thus the unit of velocity is centimetre per second, and that of acceleration is centimetre per second per second. Many of those who study dynamics to pass examinations never attain to the idea of acceleration; they can grasp the idea of velocity, but they cannot discriminate the idea of velocity from it. Even some of those who write on dynamics show by their use of centimetre per second or foot per second as a unit for expressing an acceleration, either that they have not grasped the distinction, or that they do not see the importance of a distinctive notation. It must, however, be admitted that the author has the printer to reckon with; and the latter supposes, not unnaturally, that the repetition of the *per second* is a mistake.

In the C. G. S. System F is the *dyne* and W the *erg*. The notation for the unit of heat is *gramme of water* by *degree centigrade;* it is sometimes called the *gramme-degree*. The latter is a name formed after the manner of compounds, while the former is a notation expressing the nature of the dependence.

From the notation for a unit we can derive its dimensions, or the multiplier for changing from one set of fundamental units to another. Take for example the unit of force. Let l L new = L old, m M new = M old, and t T new = T old. From an inspection of the manner in which the units enter into the notation for the unit of force, we derive

$$\text{m l t}^{-2}\ \text{F new} = \text{F old}.$$

Properly speaking, the dimensions are the indices of *m l t;* in the above case 1, 1, and —2, while m l t^{-2} is the multiplier for changing from one unit to another. From the notation for a unit we can infer the multiplier; but from the multiplier we cannot infer the notation.

By means of the notation we readily see what ideas or units are equivalent to one another. For example,

1 erg = gm by cm. per sec. per sec. by cm.;

therefore 1 erg per cm = gm by cm per sec per sec, and 1 erg per gm = cm. per sec. per sec. by cm. Thus the unit of force is equivalent to erg per cm, and erg per gm expresses the idea of potential. The rule is to change *by* into *per*, or *per* into *by*, when removing a unit from one side to the other.

The units encountered in electrical science are the most complex of all; and the labours of scientific men in overcoming them have had an indirect effect in advancing the methods of elementary calculation. It is, however, only the notation for the principal units P and Q in terms of L, M, T that is complex. Given P and Q the notation for the remaining units is simple enough. Of the two units of electric quantity the notation for the electrostatic unit is the same as that for the unit of magnetic pole, while the notation for the electromagnetic unit involves that for the magnetic pole.

General symbols for a unit such as M and V are of great service in elementary calculations apart from the use in a notation for derived units. The chemist is always using the phrases 'part by weight,' and 'part by volume;' these ideas are expressed by M and V.

NOTATION FOR GENERAL UNITS.

I.—*Geometrical.*

Quantity.	Notation.	Dimensions.
Length	L	l
Surface	L by L, S	l^2
Volume	L by L by L, V	l^3
Angle	L arc per L radius	l^0
Sine	L opposite per L along	l^0
Curvature	Radian per L	l^{-1}

II.—*Kinematical.*

Time	T	t
Velocity	L per T	$l\,t^{-1}$
Acceleration	L per T per T	$l\,t^{-2}$
Angular Velocity	L arc per L radius per T	t^{-1}

III.—*Dynamical.*

Mass	M	m
Density	M per V	$m\,l^{-3}$
Mass-vector	M by L	$m\,l$
Momentum	M by L per T	$m\,l\,t^{-1}$
Force	M by L per T per T, F	$m\,l\,t^{-2}$
Pressure	F per S	$m\,l^{-1}\,t^{-2}$
Work	M by L per T per T by L, W	$m\,l^2\,t^{-2}$
Activity	W per T	$m\,l^2\,t^{-3}$

IV.—*Thermal.*

Temperature	Θ	θ
Heat	M of water by Θ, H	$m\,\theta$
Thermal capacity	M of water by Θ per M	θ

IV.—*Thermal (Continued).*

Specific heat	M of water = M of substance	1
Latent heat	M of water by Θ per M	θ
Rate of expansion, linear.	L increment per L original per Θ increment	θ^{-1}
" " cubical.	V increment per V original per Θ increment	θ^{-1}
Conductivity	H per T per S per (Θ per L)	$m\,l^{-1}\,t^{-1}$

V.—*Electrical.*

Quantity.	Notation.	Dimensions. Electrostatic.	Dimensions. Electromagnetic.
Magnetic pole	$\sqrt{F}$ by L, P		$m^{\frac{1}{2}}\,l^{\frac{3}{2}}\,t^{-1}$
Intensity of field	F per P		$m^{\frac{1}{2}}\,l^{-\frac{1}{2}}\,t^{-1}$
Magnetic potential	W per P		$m^{\frac{1}{2}}\,l^{\frac{1}{2}}\,t^{-1}$
Magnetic moment	P by L		$m^{\frac{1}{2}}\,l^{\frac{5}{2}}\,t^{-1}$
Quantity of electricity	$\sqrt{F}$ by L, Q elect'static.	$m^{\frac{1}{2}}\,l^{\frac{3}{2}}\,t^{-1}$	
" "	F per P by (L rad.)^2 per L arc by T, Q electromagnetic		$m^{\frac{1}{2}}\,l^{\frac{1}{2}}$
Intensity of electric field	F per Q	$m^{\frac{1}{2}}\,l^{-\frac{1}{2}}\,t^{-1}$	$m^{\frac{1}{2}}\,l^{\frac{1}{2}}\,t^{-2}$
Electric potential	W per Q	$m^{\frac{1}{2}}\,l^{\frac{1}{2}}\,t^{-1}$	$m^{\frac{1}{2}}\,l^{\frac{3}{2}}\,t^{-2}$
Electric density	Q per S	$m^{\frac{1}{2}}\,l^{-\frac{1}{2}}\,t^{-1}$	$m^{\frac{1}{2}}\,l^{-\frac{3}{2}}$
Electric Capacity	Q per (W per Q)	l	$l^{-1}\,t^{2}$
Current	Q per T	$m^{\frac{1}{2}}\,l^{\frac{3}{2}}\,t^{-2}$	$m^{\frac{1}{2}}\,l^{\frac{1}{2}}\,t^{-1}$
Resistance	W per Q per (Q per T)	$l^{-1}\,t$	$l\,t^{-1}$
Conductivity of a substance.	Q per T per S per (W per Q per L)		$l^{-2}\,t$

Messrs. Livingstone and Macdougall made some remarks and the President noted the small attendance of those able to discuss the subject of the paper as a reason for dividing the Institute into sections.

TENTH ORDINARY MEETING.

The Tenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, January 17th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of Donations and Exchanges received since last meeting was read :—

1. Catalogue of Canadian Plants, Part II., Gamopetalae, by John Macoun, M. A.

2. The Canadian Practitioner for January, 1885.
3. Science, Vol. V., Nos. 100 and 101, Jan. 2nd and 9th, 1885.
4. Journal of the Asiatic Society of Bengal, Vol. LIII., Part I., No. 2, 1884.

Prof. Loudon read a paper on "The Spherical Aberration of Mirrors." This paper has been incorporated with a former paper by Prof. Loudon. (See *ante*, page 16).

The Hon. G. W. Allan then read the following paper on

SOME OF OUR MIGRATORY BIRDS.

There are few subjects connected with bird life, more interesting than the migration of these denizens of the woods and fields, as they come to us in Spring after many months of absence – or leave us again at the approach of autumn or the keen air of early winter to wend their way back to milder and more genial climates. To an observant lover of nature there is an especial charm in the recognition of the first notes of each winged visitant, heard almost before they are seen, and bringing back life and melody to our woods and fields after the long silence of winter; and so again in autumn, there seems to be a peculiar plaintiveness in the call-notes of the gathering flocks, as if bidding us farewell before setting out on their long journey.

Even winter, however, with its frosts and snows has its visitors, coming from still colder latitudes, spending a few brief weeks with us, and at the first approach of the sunny days and soft airs of Spring, wending their way back to the far North.

In the limits of a paper such as this I shall not attempt to offer anything like an exhaustive list of our birds of passage, I shall confine myself to giving, as it were, a rough sketch of the ornithological characteristics of each month as marked by the arrival or departure of some of the various species of our land birds.

To begin with the year, for winter, as I have said, has its visitors as well as summer, and from the icy shores of Greenland, and the frozen north, comes to us that beautiful little bird, the Snow Bunting Plectrophanes Nivalis, the harbinger of cold and stormy weather. Flying generally in large flocks, as their bodies are seen against the blue sky, they look almost like large snow flakes drifting before the wind.

So associated are they with storm and cold that in northern

Europe where they are also found in great numbers in winter, they go by the name, among the Swedes, of "Illwarsfogel" or bad weather birds!

The time of their arrival here varies with the character of the weather. In very cold winters I have seen them as early as 10th and 15th of December, and I have known them to remain in some seasons as late as the first week in March. They are said to make their appearance in Hudson's Bay at the end of March or early in April remaining there for a few weeks and then wending their way still further north to breed on the shores of Greenland or even desolate Spitzbergen! As the food of these birds consists almost entirely of seeds of various wild plants, their means of subsistence amidst the deep snows of winter would seem to be precarious enough. Nevertheless they become very fat, and in the Province of Quebec, where they are found in much greater numbers than here, they are slaughtered most mercilessly for the market, and among our French friends "snowbirds on toast," I am sorry to say, form a standing entree in the bill of fare of a fashionable dinner.

The snowy owl, Nyctea Scandiaca, one of the most beautiful of our rapacious birds, is another winter visitor, at one time very common even in this neighborhood. I have seen them in considerable numbers on the Island on the other side of our Toronto Bay in the months of December and January. Nothing can exceed the exquisite softness and beauty of their thick, warm plumage, which enables them to bid defiance to the severest cold, and as they are not overnice in their choice of food, rats, mice, fish and small birds, all seeming to come alike, they are in no danger of starving even in the most wintry weather.

During this and the next month when strolling through the park or even through some of our streets, where bordered by trees or gardens, the attention of the passer-by may sometimes be attracted by the very sweet and melodious call-notes of two or three handsome birds, busily engaged in feeding upon the tender buds of a maple or stripping off the berries of the mountain ash, and if his curiosity induces him to approach them more closely (and they are often extremely tame and fearless) he cannot but be struck with the beauty of the plumage of some of the number, the head and upper part of the breast and back of the male birds more especially being beautifully marked with delicate shades of orange and crimson. These

birds are the Pine Grosbeak *(Pinicola Enucleator)*, a rare visitor in some years, but in severe winters it comes to us in considerable numbers, being met with, not only in our woods, but sometimes venturing fearlessly, as I have said, into the streets and squares of our towns. They occasionally do a good deal of mischief to the young buds of both fruit and ornamental trees.

During a very severe winter many years ago these birds came into my own grounds in great numbers. Observing that wherever any withered apples were left hanging on the trees in the orchard they were eagerly attacked and torn to pieces by the Grosbeaks, apparently for the sake of the seeds, I had a quantity of apples cut up and and strewed on the steps of the verandah of the house, and before long I had as many as ten or a dozen of these beautiful birds feeding at the same time, and so tame and fearless did they become, that they would allow the members of the family to watch them from the windows. They did not, however, always content themselves with the food thus provided for them, but did a good deal of mischief that winter to the young buds of the cherry and apple as well as many of the ornamental trees. They leave us generally about the end of March.

The Bohemian Wax-Wing *(Ampelis Garrulus)*, is another rare winter visitor only appearing in seasons when extreme cold has driven it down from more northern latitudes. In plumage it resembles very closely the Ampelus Cedrorum, the Cedar Bird, common Wax-wing, or Cherry Bird, so well known, as an active depredator in our gardens and orchards. The Bohemian Wax-Wing, however, is considerably larger and the colouring of the plumage, though very similar, is richer and deeper. It has the same curious horny tips like red sealing wax on the secondaries of the wings.

The Crossbills, both the Red Crossbill *(Loxia Curvicostra Americana)*, and the White-winged *(Loxia Leucoptera)*, have been classed as winter visitors only in Ontario, and so has that elegant little bird the Pine Finch *(Chrysomitris Pinus)*. I have met with all three, however, in the neighbourhood of Lake Simcoe during the summer, and the Crossbills undoubtedly breed in the pine and Hemlock woods and may be seen there all throughout the year.

The last of our winter visitors that I shall notice is the Shore Lark, *Eremophila Alpestris*. Speaking from my own experience, it is not often met with in this part of Ontario, though it is found

occasionally and in low and marshy grounds on the shores of this lake, and I have also seen it frequently in the neighbourhood of Ottawa.

It feeds on the seeds of various grasses and weeds, and such insects as it can obtain at the season. Its call note is very soft and melodious, and I have heard the male bird in the early days of March utter a short but very sweet song. It is then just on the point of setting off on its migration northward and its plumage has begun to assume something of its summer brightness, the black tufts of feathers on the head and the crescent shaped patch of black on the throat of the male bird are then very conspicuous.

Sometimes as early as the last week of February, though generally in the first warm days in March the cawing of the crows is heard for the first time, and their harsh voices sound pleasantly to our ears because they are associated with the commencing spring.

It is true that occasionally in very mild winters one or two individuals do sometimes remain in particular localities, but these are exceptions to the general rule and they may fairly be classed among our migratory birds.

I have said that their voices sound pleasantly because they are associated with the coming spring, but for my own part, I confess, it is only at that particular season that I can listen to them with any degree of complacency. They are then doing good service in feeding upon noxious insects and vermin of many kinds, but as the spring advances and the various small birds begin to lay their eggs and hatch their young, the crow becomes the ruthless destroyer of both eggs and young, and scores of the eggs or young of our Song Sparrows, Warblers, Thrushes and various other birds fall a prey to its voracious appetite.

First among the arrivals in March of our smaller migratory birds is the Song Sparrow, *Melospiza Fasciata*, and its short but sweet song is the first to proclaim "that the winter is over and gone, and the time of the singing of birds is come." The time of its arrival, as I have noted it in various years, varies from the 16th to the 23rd of March, sometimes, in very backward springs, not until the first week in April.

Almost at the same time with the Song Sparrow comes the Robin *(Turdus Migratorius)*, its cheery notes, whether heard from the top of some tall maple, or as it scuttles through the bushes of the shrub-

bery, or pipes its evening song from the roof of some lofty building, is one of the most welcome sounds in Spring. Indeed I know of none among all our feathered visitors so worthy of being cherished and protected. It comes about our lawns and dwellings, and if only unmolested will build its nest and lay its eggs and hatch its young under the very eyes of the household. Its cheerful notes are the first we hear on waking, for the Robin is abroad at early dawn, and through the live long day it is going and coming in quest of food for itself or its young, stopping every now and again for a short snatch of cheery song, and then, as the sun goes down, perched on some tree, or it may be high up on the gable of some lofty building, it will pour forth its sweet notes continuously—sometimes for half an hour or more; the last of all the grove to relapse into silence. The quantities of grubs, caterpillars, cutworms, crickets and grasshoppers which are captured and devoured by the Robin and other thrushes is something marvellous; and as the Robin not unfrequently raises three broods in the year, his species must destroy more of these insects than almost all other birds put together. Nothwithstanding all this because the Robin occasionally treats itself to a few strawberries or cherries or grapes by way of desert, it has been proscribed in some places by the fruit growers, who have had influence enough to persuade our local legislature to take it out of the list of insectivorous birds protected by law, and allow, in the words of the act, "Any person during the fruit season to shoot and destroy the Birds known as the Robin and the Cherry Bird." It is scarcely fair to the Robin to put it in such company, though even the Cherry Bird, with all its fondness for fruit, assists in ridding our fruit trees of a host of insect enemies which infest them. In the case of the Robin, however, I have repeatedly, again and again, watched it while feeding its young—earth-worms, grubs, vine-worms, caterpillars and other insect food were being brought all day long, and on these the young birds were fed exclusively, and when it is borne in mind that the Robin, as I have already stated, not unfrequently raises three broods in the year, their services in the destruction of insect pests must more than pay three times over for all the fruit they devour.

Quickly following upon the arrival of the Robins comes the Blue Bird *(Sialia Sialis)*. Not so bold and fearless as the Robin, it does not come about our dwellings and grounds in quite the same

familiar way; nevertheless, it is a sociable, gentle bird, and if unmolested will build and rear its young in the same spot, under the eaves of some out-building, or in a deserted Martin's box or even a knothole in a fence post.

For several years when the large rustic pavilion was standing in the centre of the Horticultural Society's Gardens the Blue Birds used to build regularly every season among the rafters of the roof, and their soft warbling notes could be heard all through the summer as, perched on the ridge, they dressed and plumed their feathers after returning from the capture of some moth or grasshopper or other insect prey.

Sometimes in the last days of March, though generally not until the 3rd, 6th or 7th of April, comes an old friend, familiar to most of us from boyhood, the Pee-wee, Fly-Catcher, *Sayornis Fusca*. Although it has but the one plaintive note, *pee-wee*, sometimes long-drawn out, and then changing into a little tremulous, murmuring twitter, as flying down from its perch on the housetop, or the gable of some old barn, it snaps up a passing insect, yet few sounds of bird voices are pleasanter to the lover of nature, for it is suggestive of warmth and sunshine, the waking up of insect life and all the gladness and freshness of spring. What should render this Fly-Catcher a special favourite with us is the tameness and familiarity with which it harbours about our dwellings, and its attachment to the same spot wherein to build its nest year after year; it may be under the eaves of the barn or stable, or, as if boldly claiming our protection, it will attach its fabric of mud and moss, and fine grasses, to some convenient ledge under the roof of our verandahs, where its proceedings may be watched day by day by all the inmates of the house.

By the 5th or 10th of April the Tree Sparrow, *Spizella Monticola*, and the Chipping Sparrow, *Spizella Domestica*, have made their appearance. The latter well merits its epithet of Domestica, for it is one of the tamest and most sociable of our feathered friends, and under the name of "grey bird" is known to almost every child in the country. No sweeter song is heard at this season of the year than the warbling of that handsome bird, the Purple Finch, *Carpodacus Purpureus*, which, although it may occasionally be seen in a very mild winter in company with the Siskin, or Crossbills, yet is a sufficiently rare winter bird to make its advent the more marked

when April comes, and we catch sight of the handsome cock-bird on some bright morning in his full livery of shaded crimson, perched on the topmost bough of an apple tree, and pouring forth a succession of sweet, warbling notes, sometimes for half an hour together. Like the Pine Grosbeak, the Purple Finch occasionally commits great depredations on the buds of our fruit trees; and later in the season, when the cherries are ripe, it rivals the Waxen Chatterer in its devotion to that fruit. The plumage of the adult male is very handsome: The head, neck, breast, back, and upper tail coverts are a rich, deep lake, approaching to purplish crimson on the head and neck, and fading into rose colour on the belly. The quills and larger wing coverts are deep brown, edged with purplish red; and the tail feathers are deep brown, similarly margined.

That curious bird, the Towee Bunting, or Ground Robin, as it is sometimes called, *Pipilo Erythrophthalmus*, reaches us early in April. I have generally found it in clearings on sandy tracts, such as the Humber plains, partly overgrown with scrub oak and pine, where, among the withered leaves and underbrush, it passes much of its time searching for worms, the larva of different insects and uttering the peculiar note of Towee-towee.

As the power of the sun becomes sensibly felt, and in spite of cold winds and an occasional night's frost, there is an increasing mildness and softness in the atmosphere, and on some bright morning we unexpectedly hear a cheery twittering note above our heads, the Swallows have come! and despite of the old adage, we are ready to welcome the arrival of these harbingers of summer as a sure pledge that all frost and cold are over, and warmth and sunshine will now be ours.

The first to make their appearance of the swallow tribe are the White-bellied Swallow, *Irodoprocne Bicolor*, and the Sand Martin, *Cotile Riparia*. They both arrive nearly at the same time, about the 9th or 10th of April, though I have the arrival of the White-bellied Swallow noted in my diary one year on the 30th of March.

The Barn Swallow, *Hirundo Erythrogastra Horreorum*, comes next, about 15th of April. The purple Martin, *Progne Subis*, and the Swift or Chimney Swallow, *Chetura Pelasgica*, are generally the last to arrive, about the 20th of April, sometimes not until the very end of the month, though again I have the Purple Martin down one year as reaching us on the 9th of April.

The Purple Martin is a bold, fearless bird, attacking even hawks and crows when they come in his way. Its flight unites in it, all the swiftness, ease, rapidity of turning and gracefulness of motion of its tribe. It is well known or used to be well known to all dwellers in town and country as the constant tenant of the numerous bird boxes, or swallow-houses which are erected, sometimes on the sign board of the Village Inn, or on some out-building in the farm yard, or even in the streets of the town. Of late years, however, I fear that the English Sparrow has to some extent ousted the Martin from its old quarters in the towns, for, though no match individually, the sparrows by their numbers and pertinacity so worry and disgust the bigger bird as ultimately to drive it away. A few years ago a pair of Martins occupied a two story bird house in the yard attached to the Canada Company's office. There were many battles at first between the Sparrows and the Martins, but at last they seemed to come to a compromise, and the Sparrows occupied one story and the Martins the other, and brought up their respective broods without further fighting. Since then, however, the Martins have never returned and I cannot help suspecting that the same results may have followed in other places, for the bird certainly seems to be less numerous than in former years.

The Blackbirds and Grakles now make their appearance, and the reedy borders of our ponds and marshes, and the neighbouring woods are filled with these noisy birds. The Cow Blackbird, *Molothrus ater*, arrives first. The Swamp Blackbird or Red Wing Blackbird, *Agelæus Phœniceus*, sometimes in the last days in March, but more frequently about the 9th or 10th of April, and the Grakle or Crow Blackbird a little later. Little parties of the Cow Blackbird may be seen on fine mornings visiting the pasture fields and lawns, running about the grass in search of insects larvæ and worms, and betaking themselves at nightfall, to roost among the tall reeds and sedges on the margin of some swamp or river. This bird like the Cuckoo of Europe follows the singular custom of not making a nest of its own, but deposits its eggs, one at a time, in the nest of some other bird, leaving them to the care of a foster parent. When the female is about to deposit her eggs, she moves about uneasily from tree to tree until she discovers a nest from which the rightful owner is absent at the moment, and then quietly drops in her egg and flies off. It never deposits more than one egg in the same nest,

although it is probable it thus leaves several in different nests. The birds employed as foster parents are all smaller than the Cow Blackbird—the Chipping Sparrow, the Maryland Yellow Throat, and some of the smaller species of Fly Catcher are among those most favoured, the Chipping Sparrow perhaps most frequently with us. As the young blackbird grows up it is provided for by its foster parents with all the care and assiduity that would be displayed towards their own offspring, and long after it has left the nest it continues to be fed by its affectionate guardians.

Frequently where the Chipping Sparrow has been the foster mother I have seen the tiny little bird carefully placing some choice worm or dainty insect in the open mouth of its great clumsy fluttering nursling, nearly half as big again as itself, whose sooty brown colour, as well as its size, offered a curious contrast to the delicately marked plumage and pretty slender form of its foster mother.

The Marsh Blackbird is well known to all by the extremely handsome plumage of the male bird, and any visitor to the meadows or marshes in the neighborhood of the Humber or the Don must be familiar with the peculiar song, if song it can be called, of "quonk-a-ree," sometimes uttered by half a dozen birds at a time from early dawn to midnight.

The Crow Blackbird or Purple Grakle, *Quiscalus purpureus*, although its food consists at some seasons of larvæ, caterpillars, moths and beetles, is the most mischievous to the farmers' crops of all the blackbirds, and is a serious nuisance in some of the localities in which they abound.

About the 10th or 15th of April, sometimes a few days earlier, if the season is favourable, the Grass Finch or Bay-winged Bunting, *Pocœcetes Gramineus*, arrives, and soon makes its presence known by its deliciously sweet song, which may be heard all through this and the next month in our fields and open pastures and the borders of our woods, from "morn till dewy eve," being like the robin fond of pouring out a last farewell to the closing day. Its neatly built nest placed usually under a tussock of grass, constructed of fine grasses and roots bent and twined together, and the whole lined with hair-like roots and grass, may be met with in the open pastures or fields, sometimes as early as the end of April or the first week in May.

As the month advances fresh notes from new arrivals continually

strike upon the ear. Strolling through the garden or the orchard we may hear a low, sweet, soft call-note like that of a tame Canary, followed immediately by a rapid joyous warbling, it is the American Gold Finch, *Astragalinus tristis*. This pretty, elegant, little creature, like the Purple Finch, sometimes, though rarely, lingers with us through a very mild winter, but generally they move off in large flocks to the south at the approach of autumn and do not return to us until towards the middle or end of April. The cock bird when in full plumage is one of the handsomest of our songsters, and unlike many others of our more gaily plumaged birds sings with great sweetness.

As April draws to a close and we pass into May, if the weather be warm and genial, not only the woods but our gardens and shrubberies are suddenly full of a host of charming little visitors, most of whom tarry for a very brief space disappearing again in a week or two, journeying on towards their northern breeding places. I allude to that large family the *Sylvicolidae* or "Warblers." some of which remain with us all through the summer, but large numbers of them merely pass through on their way northward in spring, and again on their return journey to the south in autumn.

Among the latter I may refer to a few which I have observed both in this neighbourhood and in the woods about Lake Simcoe. The Black Throated Green Warbler, *Dendrœca Virens*, and the Yellow Rumped or Golden Crowned Warbler, *Dendrœca Coronata*, are two most frequently seen and both remarkable for the beauty of their plumage, though in this latter respect, that lovely little bird the Blackburnian Warbler, *Dendrœca Blackburniæ*, surpasses them all.

The pretty little Blue-Yellow backed warbler, *Parula Americana*, is said to breed in Canada, probably in the more northern parts of Ontario and Quebec, but I have never met with its nest, nor do I remember ever seeing it during the summer months. Two species, the Canadian Fly-Catching Warbler, *Myœodivetes Canadensis*, and the Black and White Creeping Warbler, *Minotilla Varia*, frequently breed in our northern woods. Of those who take up their abode with us for the summer the best known and most familiar to most of us from its short but sweet and cheery song and its social confiding disposition is the Yellow Warbler, *Dendrœca Aestiva*.

It has little fear of man allowing itself to be approached quite closely, but during the breeding season the little bird shows great

anxiety for the protection of its eggs or young, flying in front of the prying visitor or tumbling along the ground as if wounded after the manner of the partridge with wings and tail outspread, it endeavours by every artifice to attract the unwelcome intruder from the neighbourhood.

It is one of those birds occasionally selected by the Crow Bunting as a foster mother for its young, and not unfrequently the single egg of the latter may be found deposited among the five or six eggs of the Warbler.

Of all our summer visitors the most brilliant in plumage, almost tropical in its character is the Scarlet Tanager, *Pyranga Rubra*, which arrives from the south from the 10th to the 15th of May. The male bird is too well known to require description, but it may not be generally known that the female has none of the gorgeous colouring of the cock bird, but is olive green above and yellowish beneath, wings and tail brown, edged with olive colour, and the young males for the first season are colored like the females, but generally exhibit more or less of red feathers among the greenish ones. I have met with the nest and young of this handsome bird in the woods about Lake Simcoe, but only occasionally, and as a general rule they seem to disappear from this part of Ontario like so many of their companions, the Warblers, after a very brief stay in the early part of May.

Following close upon the arrival of the Scarlet Tanager, and often seen with it, comes that beautiful bird, the Crimson-breasted Grosbeak, *Zamelodia Ludoviciana*. In general it is a shy bird, keeping much in the forest, where it feeds mostly upon the seeds ef the birch and alder, the tender buds and blossoms of the trees, and upon insects which it catches on the wing ; but when the cherries are ripe in the gardens and orchards, it often approaches our dwellings, and certainly repays us for the little fruit it consumes by the delicious softness and melody of its notes. They are very numerous in the woods at Lake Simcoe, breeding there, and remaining with us until the middle of September.

Yet another visitor, whose gorgeous plumage quickly attracts attention to its arrival following the Tanagers and Grosbeaks, is the beautiful Baltimore Oriole, *Icterus Galbula*. Gliding from branch to branch in search of insects, the brilliant livery of the male renders him a conspicuous object, even if his clear, mellow whistling notes,

which may be heard at a long distance, did not attract attention. In the woods, the Oriole generally builds in some tall elm or gigantic button-wood tree; but their singular nests are occasionally found in our orchards, suspended from the extremities of the branches of the apple or the pear. The nest is woven, as you all probably know, in the shape of a purse or bag, and is generally attached to two or more forked twigs by threads of the silk weed, or fibres of other wild plants, and not unfrequently when they can obtain them by pieces of string or thread, which the bird picks up near the neighbouring houses. With the same materials mixed with hair, wool or tow, it interweaves a warm and substantial fabric of nearly six or seven inches in depth, the bottom part being lined with horse hair.

The White Browed Crown Sparrow, *Zonotrichia Leucophrys*, and the White Throated Crown Sparrow, *Zonotrichia Albicollis*, both arrive in May. The singularly sweet notes of the latter bird must be well known to all observers. I have observed that they are generally most musical immediately before rain or during the frequent showers of the early part of the season.

Any one strolling through the meadows or near the margin of some stream or reedy pond during the latter part of May, will often hear an outburst of the most curious, jingling, joyous, laughable medley of a song that any bird throat ever uttered, and if he catches sight of the singer he will see it nodding its head, quivering its wings and with open mouth rattling out its curious notes as if its very life depended on it; this is the Bobolink Reed Bird or Rice Bunting, *Dolichonyx Oryzivorus*. Its plumage is almost as curious as its song, a mixture of black, white and yellow, disposed in a sort of piebald fashion over the body.

Much about the same period of the month a very different song may be heard, no one who has listened to it as from the topmost twig of some tall oak on some fine May morning, the singer pours forth its sweet cadences so full of melody, but will forever scout the assertion so often made by those who know little of our Canadian birds that they are destitute of song. It is the Ferruginous Thrush or Brown Thrasher as it is sometimes called *Harporynchus Rufus*, that is filling the air with melody, and in my judgment, except the Skylark and Nightingale of Europe, there are few birds whose vocal powers can compare with this thrush. If we desire a strong contrast we can have it in the harsh cry of another summer visitor

often seen with the Thrush and other fruit loving birds in our gardens later in the year—the Cat Bird, *Mimus Carolinensis* Its curious harsh mewing like a cat, which it utters when alarmed, has earned for it the specific name of Felivox from some authors, which is certainly much more appropriate than *Carolinensis*. Nevertheless the Cat Bird is possessed of vocal powers which entitle it almost to be called the Canadian Mocking bird, for I have heard it imitate the notes of the Thrush and a host of other birds, and it will sometimes pour forth its "mocking" song until long after the sun has gone down.

Before the end of May the Wood Thrush, *Turdus Mustelinus*, and Wilson's Thrush, (Veery) *Turdus Fuscescens*, have arrived and their song may be heard in the woods at break of day and the last thing towards evening; and in the fields the sweet notes of the Meadow Lark, *Sturnella Magna*, are now mingled with the voices of the Song Sparrow and Baywing.

That bold and handsome bird the King Bird, *Tyrannus Carolinensis*, may be seen perched on some fence post, or outbuilding, or tall tree, ready to give battle to birds twice his own size, and especially to the Crow, to which he seems to have a special dislike. The various species of Fly Catcher, which come to us in summer, have now all arrived, and the Wood Pecker tribe, Golden wing and scarlet headed and others, are to be met everywhere as you pass through the fields and woods; but I must not go on with my catalogue any further, for I have already exceeded my proper limits in this paper, and I shall conclude with noticing a bird that may not be so familiar to many of you, which is always associated with the glowing heat of summer, when except in the early freshness of the morning the songsters of the grove are comparatively silent. It is then that from the deep shade of the woods, or from some cool thicket near our gardens, even during the hottest hours of the day, comes the soft but monotonous Coo-coo of the *Coccygus Americanus*, the yellow billed Cuckoo. It and the black billed Cuckoo, *Coccygus Erythrophthalmus*, which is very similar in its habits, though the latter is, perhaps, not quite such a shy bird as the yellow billed, frequents our woods all through the summer, and unlike the European bird, show much care and affection in bringing up their young, although their nest is rather a careless fabric, being composed of a few dry twigs, mixed with weeds and grass, and with so little concavity as sometimes to endanger the safety of its young.

I have thus only just faintly outlined, as it were, some of the "ornithological characteristics" of a *part* of the year. The details, if properly filled in, would occupy far too much of your time on the present occasion, even if I confined myself to the birds arriving in the spring and early summer. I must, therefore, defer any further notices of our "migrants" to another opportunity.

The paper was illustrated by specimens.

Remarks on some of the birds referred to were made by Messrs. Murray, Vandersmissen, Keys, Squier, McKenzie, Livingstone, Bain, Brodie, and Dr. Scadding.

ELEVENTH ORDINARY MEETING.

The Eleventh Ordinary Meeting of the Session 1884-'85, was held on Saturday, January, 24th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The Hon. G. W. Ross, Minister of Education, and David B. Dick, Esq., Architect, were elected members of the Institute.

The following list of donations and exchanges was read :

1. Monthly Weather Review, Dominion of Canada, for December, 1884.
2. Science, Vol V., No. 102, January 16th, 1885.
3. The American Journal of Science, for 1884, Vols. XXVII. and XXVIII.
4. Report of the Observatory of Yale College for 1883-'84.
5. Transactions of the Manchester Geological Society, Vol. XVIII., Part III., Session 1884-'85.
6. Proceedings of the Royal Geographical Society, N.S., Vol. VII., No. 1, for January, 1885.
7. Quaritch's Catalogue of Spanish Literature, No. 361.
8. Proceedings of the London Mathematical Society, Nos. 195 to 230, forming Vol. XIV. and part of XV.

   List of Members of the London Mathematical Society, November 13th, 1884.
9. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, 4 e Série, 37 e Aunée, 10 e Cahiér, October, 1884.

Donation of $50 to the Funds of the Institute, by Sandford Fleming, Esq., C. M. G.

On motion of Dr. Kennedy, seconded by Mr. George Murray, it was resolved that the thanks of the Institute be tendered to Mr. Sandford Fleming, C. M. G., for his generous donation.

D. A. O'Sullivan, M.A., LL.B., read a paper entitled

SYSTEMATIC CHARITY.

Every large city in the world has a destitute population ranging probably about five per cent. of the whole number of its inhabitants. There are the poor who are unable to work, the poor who are unwilling to work, and the poor without work for them to do.

The first of these classes include the sick, the aged, the deformed, and those who, whatever their disposition may be, are unfit to support themselves. They form the great mass of any city's permanent poor, and they are the ones towards whom the energies of the charitable and the actions of the Legislature are directed.

The second—and an alarmingly increasing class — furnish the pauper and the tramp of modern civilization, and it is said on the authority of a very experienced writer that "the pauper, the imposter, and the fraud of every description carry off at least one-half of all charity, public and private, and hence there is a constant and deplorable waste in the alms-funds of every large city."

The third class of poor, able and willing to work, but without work to do, is a fluctuating class, absent in one city and present in another, and varying also in seasons in the same city. They form the lower order of working classes; if work is provided for them they may arrive at a higher level, if not they become depauperized and are the scandal of society.

I have divided the poor whom the taxpayer and the charitable have to support into three classes, with reference to their capacity or inclination for work—for labor of some kind; but there are others with whom the public are concerned, such as the criminal of minor offences, who is kept in gaol or in prison at the public expense; the drunkard, who finds his way to the same institutions, and a large miscellaneous class who, by reason of vice that is a legal crime, or

vice that may not be such, are maintained in the hospitals and infirmaries and magdalen asylums, and whose children are to be found in the various institutions from the infants' and children's homes till they are ripe for a repetition of the vices and career of their parents.

The social and economic problems in regard to the poor are neither few nor simple of solution. What is to be done for the honest poor who desire to better their condition? and what remedies can be offered to repress the degrading process by which a poor man becomes a pauper? How, in fact, can the worthy poor be enabled to help themselves, and how can the pauper and the tramp be exterminated? The task of maintaining the helpless is a very small one compared with the tax to maintain the idle and the undeserving. The ratepayer and the charitable have to support not only themselves but the poor and destitute of every kind, and it is important to them to aid in any effort towards the co-operation and efficiency of our charities.

Charity comes to be administered within a score or so of institutions in cities like Toronto, and so far as indoor relief or assistance is concerned there is not so great a necessity for any organized co-operation. The waste and abuse and imposture is chiefly in regard to outdoor relief, and it is all the more in those cities where no well organized association of charities exist. It is of this organization of alms-giving that I propose to treat principally in this paper.

Within the last seven years 36 charity organizations have sprung up in the United States, and it is on the experience of the workings of these institutions that I propose to direct your attention. I have preferred relying upon the reports of charities in those cities having so many features in common with our own, and so have not gone into the workings of any other foreign charities. The *Monthly Register*, of Philadelphia, collects information from all quarters, and is the official journal for a large number of charity organizations. It is obvious that wherever a Poor Law system prevails there would be fewer materials for our guidance in organizations than where no legislation is required for their efficient working.

The principles upon which American charity organizations are founded are very simple and very well understood.

A charity organization does not mean one mere charitable society. "It means," in the language of Mr. Kellogg, the organizing Secre-

tary of the Associated Charities of New York City, "an alliance offensive for economy, thoroughness and efficiency of all such organizations of public official relief, and of congregational and individual beneficence, into one harmonious and co-operative body, maintaining intercourse and comparison through one central agency, and pledged to united and concurrent efforts for the suppression of the pauper and the rescue of the deserving poor."

It means a common field in which men of all beliefs and men of no belief can work side by side in the cause of humanity. It means an examination into the cases of individual destitution by a personal canvas, and it means a thorough investigation of every applicant, so as to detect and expose imposture, and is, therefore, a comparison and exchange of information in confidence.

This central agency or bureau does not interfere in any way with the workings of the existing charities. It gives no relief except in rare, urgent cases. It excludes no worthy applicant, and it frowns down any attempt at proselytism. It aims to prevent imposture, to reduce vagrancy and pauperism, to relieve the destitute, and to give relief in return for employment. It has its agencies, its branch offices, its paid and volunteer officers, and as efficient a system of registration as possible.

This last—a registration of the names of all in the city in receipt of private or official relief—is not only one of the first things insisted upon, but it will be noticed in comparing the reports for different years that it is considered of very increasing importance. The report from Baltimore (and I quote the latest issued) says that the charity directory has already proved of valuable assistance. In Brooklyn, Boston, Detroit, and many other cities, a map is prepared, the names of applicants collected as far as possible, and a list of those obtaining relief from the circle of charities in the city.

The manner in which this was done in Buffalo is a fair example of what can be done with little expense. "Circulars were sent to all church societies, relief societies, benevolent societies and fraternities, and to all asylums and hospitals, asking for particulars as to their mode of operation, the kind of relief given, &c. Then the books of the Poor-master's office were copied, and shortly after, through the kindness of the Superintendent of Police, blanks were delivered at every house in the city by the police, asking for full particulars of any relief that any citizen was giving at that time to

any poor person or pensioner. These forms were collected by the police twenty-four hours after delivery, and out of some 30,000 issued, some 3,000 were returned filled in." "And this," says the very able writer on the subject of Charity Organization, the Rev. Mr. Gurteen, "our first work of registering the names of all in the city in receipt of relief, whether official or private, was begun." Books were then opened for indoor and outdoor relief, and classified as public or private, and the information methodically arranged, with the names in alphabetical order. It was found that the same person, in some cases, was in receipt of relief from three or four different societies, from a dozen different individuals, and from one or more churches, besides being on the poor books. "It was a lesson," he adds, "Buffalo will never forget."

The Secretary of the Brooklyn Bureau of Charities says: "The value of the registry system is now proved by actual test in the principal cities of the country. The system in some form is indispensable to the intelligent administration of charity." * * * "A complete registry is the only adequate check upon those who subsist upon alms fraudulently obtained."

"In New York," Mr. Kellogg says, "we should feel ourselves powerless without it, and the bulk of the large relief societies would feel that its abandonment was a long step backward." There are 195,000 persons in the New York Registers.

One reason why this is insisted upon—and a number of other authorities could be cited—is that it corrects abuses in the outdoor relief. The tendency of outdoor relief, it is said, is demoralizing. Detroit officially reports in favour of its abolition. Brooklyn and Philadelphia have made it illegal. New York gives no outdoor relief, except to the adult blind. Buffalo has taken the same view, and great savings are reported in cities where the organizations are complete, or where outdoor relief is entirely abolished, as in Brooklyn and Philadelphia. To reduce imposture is to reduce vagrancy, and in this knowledge is really power. To know that one person is deserving and another is not, is not only to be in the way of effectual alms-giving, but it is a saving of expense and an encouragement to the relieved.

On all points of view every aim of methodical charity is assisted, strengthened and sustained for good by the completeness of its registration; registration of those who ought to be relieved, whether they

ask it or not, and registration of those who ought not, no matter how or where they apply for relief.

The other features of the American, or as it might be called, "The Buffalo Plan" of Organizing Charities, do not need especial mention. No good would be done by attempting to interfere with the existing charities, and every one would deprecate any attempt at proselytism. Charity, in this human aspect of it, as well as on the Divine side, should exclude no person, or body of persons, on account of religious creed, politics or nationality. Such an organization requires but little funds, as the rule is to give no alms. If it can direct where alms should be given and where withheld, a great good will have been accomplished. Its funds are intended to be used solely in payment of such paid officials as may be necessary. In Boston, with a population of about half a million, the expenses of the associated charities are in the neighbourhood of $13,000, but they have 25,000 people on their books, and received reports from 47 charitable societies and 571 private individuals, and employ about 600 paid agents. Last year the central office received over 30,000 reports, and sent out about half that number. In Philadelphia, with a larger population, about 1,000 or over are employed, and the expenses are very much less, only about $4,000. In Buffalo the expenses of the first year were $6,700, and it is claimed that there was a saving to the ratepayers in that year of the sum of $48,000.

The task of seeing that all deserving cases of destitution are properly relieved is, of course, one of the greatest aims of these associated charities. This is effected by a network of agencies throughout the city, at the headquarters of which the chief officer has a list of charities and a report of the person to be relieved. The visitors make a recommendation to the proper charity in order to obtain relief. This is not a thing to be done in a day or a year, and I notice that while the early reports recommend that all officers of the organizations be paid—that there be no sentiment but all business in the matter—some of them now admit that to have been an error ; that volunteer charity is, when it can be got, the right sort of charity. This would not, however, apply to the central office, which is open all day, and where a complete register of every case of relief is to be had. In communication with this central office, and revolving around it, as it were, are the district committees, and with these

the use of volunteers is not only desirable but imperative. The work could not be carried on otherwise. The usual support given to the poor, the encouragement to elevate their home life, their health, and their habits are matters for the benevolent citizen who can snatch a half hour in the week for that purpose, and comes all the better from him than from the official representative of charity.

Indeed the associated charities must do good in this direction, or do very little at all, as they are not organized to relieve the poor by giving alms, but to enquire into the cases of deserving poor and thus aid the existing charities, and secondly, to help the poor to help themselves. So long as real misery exists or is skilfully counterfeited, so long will the charitable hand out their money on the street or in their offices, no matter how many charities there may be around them. The association of charities is opposed to this thoughtless or indiscriminate giving. An English clergyman, speaking of his experience in the terrible winter of 1867-'8 in the east end of London, says that out of every shilling ticket he had given he had done four pennyworth of good to eight pennyworth of harm—the 4*d.* representing the bread which had gone into the mouths of a wretched population, the 8*d.* the premium which was given to their wasteful, indolent habits. Immediately after the experience of these times a society was started in London called the "Charity Organization Society," and it gives no relief (except in the extreme cases of despair or imminent death) without previous and searching examination. At its head is the Bishop of London ; and men like Cardinal Manning. Mr. Gladstone, Mr. Ruskin, the Earl of Shaftesbury and the Duke of Norfolk are amongst its officers.

One of the aims of a charity organization calls for special mention. The basis of relief is employment in all cases where work can be got, and where the applicant is able to work. This is easier to discuss in theory than to reduce to practice. One thing has, however, been noticed. Whenever work was obtainable the applications for relief fell off. In many cities the procuring of work is put on a commercial basis as they say ; in many the civic authorities provide employment. In Baltimore it is made a substantive charity called the Provident Wood Yard. When a man professed a willingness to work and work could not be provided, it was cruel to dismiss him as undeserving. Any man making a proper application is provided with living wages until something better can be found for him.

Tickets for this purpose are with the charitable societies and the police. When the managers of a Boston charity attached thereto a wood yard, and announced that relief would be given to no able-bodied man unless willing to do a certain amount of work, the daily number of applicants fell off at once from 160 to 49, and Mr. Gurteen adds that in every city in which the test has been applied it has been eminently successful. In Philadelphia, when an able-bodied mendicant after an offer of such a ticket refuses to send to the office for relief, the police are called upon to arrest him.

As evidences of the assistance given to the public and to the existing charities, it is reported that in Buffalo, for example, street begging is effectually done away with. In another American city the assistance given towards repressing imposture is officially stated at a decrease of 58 per cent. in the number of vagrants and 73 per cent. in the number of undeserving poor.

Even on the low ground—but one not to be forgotten—of a pecuniary saving, very complimentary figures could be given. In London in ten years the cost of maintaining the poor has been reduced 30 per cent., and in some of the American cities to more than double that proportion.

These associated charities advise the public to give no money to any applicant, but to send the applicant to their central office, where his case will be considered and attended to. If he can work and if he refuse to work, he gets nothing; and it requires no comment to shew that private charity is almost always unable to detect this unwillingness. The money given to such a person is worse than thrown away. It is an encouragement to pauperism. It is not an agreeable task for the charitably disposed to encounter these applicants and to be never absolutely certain that their offering is not squandered on the most worthless of characters. The organized charities say, We can manage these things better, and what is a trespass on your time is our employment and duty.

These charitable organizations say, in the second place: visit the poor, give your information, your assistance, to find out and detect fraud, and to ascertain who are really deserving of relief, but give your money to the existing charities. The lame and the cripple, not to speak of the man with the seven helpless children, and no fire in the house for days, are frequently found to have amassed great sums of money by begging. And this art is so profitable that it seems to

be worth acquiring. An advertisement is said to have appeared in a London paper, where the art of begging is taught exhaustively in six lessons by a person who has founded a college for that purpose. He had an assortment of professional appliances, artificial wounds, trained dogs for the blind, crutches, and could direct his students to the most lucrative streets and neighbourhoods.

Whilst the existing charitable institutions and societies are not at all interfered with by these organizations, they are assisted and protected by them. It has been said that a knowing tramp in this city of Toronto, with its churches and its two dozen of charitable institutions, could put in the winter very well, and if detected too early, could easily earn the sixty days that would entitle him to free quarters in the gaol. The church societies are largely imposed upon also, and in the many cases of slender stipends of the clergymen the imposition is outrageous. The charity of all is much greater than the good done to the recipients of it, and whilst an association, such as we have been describing, may not remedy everything, it might do a vast deal of good.

Mr. Dale stated a case that came under his observation at Newport.

Mr. Hughes approved the idea of registration of paupers.

Mr. Murray thought we had in the Combined Charities the nucleus of what is wanted, and suggested that the children of confirmed paupers should be taken charge of by the State, but that the moral reformation of the parents should be left with the church.

Mr. Vandersmissen referred to the difficulty of the State assuming the care of children of criminals undergoing punishment.

Mr. Phipps said that pauperism might be reduced one-half by stopping immigration of unsuitable persons.

Mr. Livingstone and Mr. Elvins made some remarks.

TWELFTH ORDINARY MEETING.

The Twelfth Ordinary Meeting of the Session 1884-'85, was held on Saturday, January 31st, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

W. Boultbee, Esq., C. E., was elected a member of the Institute.

The following list of donations and exchanges was read :

1. Report on the Necessity of Preserving and Replanting Forests, by R. W. Phipps, Esq.
2. Monthly Health Bulletins of Ontario, for October and November, 1884.
3. Science, Vol. V., No. 103, January 23rd, 1885.
4. Report of the Superintendent of the United States Coast and Geodetic Survey, for the year ending with June, 1883.
5. Bulletin of the Essex Institute, Vol. 16, Nos. 7–12, July to December, 1884.
6. Papers on Time-Reckoning, and the Selection of a Prime Meridian, by Sandford Fleming, C.M.G.

Mr. R. W. Phipps read a paper on

FORESTRY, AND THE NECESSITY FOR ITS PRACTICE IN ONTARIO.

I must beg the attention of my hearers for a short space to a subject which is not uninteresting, and is very important—the rapid and injurious deforesting of Ontario and the means whereby it can best be checked. When, not so long since, the white men came first hither, the forest wealth of all this region was immense. Could it have stood till now there would have been no difficulty in rapidly selling timber enough to build half-a-dozen Pacific Railways had we so chosen to invest our funds. But the settlers came ; they needed sustenance ; they could not eat the trees ; they could not sell them, and they burned them. But unfortunately, much was uselessly burned. Much land so cleared had far better have remained uncleared until to-day. I have seen near Toronto great heaps of clear pine, worth now $40 a thousand, burned to uncover poor land which gave but a crop or two, and ever since but very poor pasture. I have seen out west where great fields had been in walnut, two or

three trees, left by accident, had sold for a thousand dollars, showing that the field would have sold for a hundred thousand dollars—a field which, in its whole cleared day till now has never given a thousand profit. Much land through the Province might well have been spared the axe and yet enough been given to the field. But we cleared without method or order, each thinking the more he cleared the richer he grew, till a deadly hatred of trees seems to have pervaded the community, and their destruction was considered equally patriotic and beneficial. It is found, however that we have been under a great mistake, and that a country will grow more grain and cattle and produce them easier when one-fourth is left in woods interspersing the rest than when all is cleared. The reason of this is evident to all who consider the structure of a tree, which I will ask you to notice. Every tree draws its nourishment from the soil near its roots. It is carried upward by means of a large quantity of water, which passes with it to the leaves—the lungs of the tree. Here it is exposed to the air, changes occur, the food goes to its place in trunk, branch, or leaf, the water passes off into the air. It is said one oak may thus send off 440 gallons per day. At all events the amount transpired by a tree is large—that of a forest immense. This passes upward to the atmosphere—it is said that if it could be tinted the wood below would form no proportion in size to the vast coloured columns above—and being cool, necessarily compels precipitation on reaching a warmer stratum of moist air, and rain ensues as soon as the precipitation is sufficient. The forest is the great local cause of the showers which fertilize the spring and summer fields. The next great benefit to agriculture is the reservoir they form for water. Their bed is deep, loose, porous, a mass of decayed leaves, intersecting roots, and forest soil, which holds in reserve great quantities of water (which otherwise would flow rapidly off over the fields), and feeds therewith the innumerable underground channels which keep moisture in the soil. Once we got water by digging seven or eight feet in many places ; now we must go forty or fifty. As land is too much cleared the springs recede from the surface, and the process goes on, where allowed, till it becomes a desert where no blade of grass can grow. In history countries are known to have been rich and fruitful, to have been deprived of their due amount of trees ; to have become sterile and be abandoned by their population ; to have been sufficiently replanted, to have recovered their lost watercourses and their vanished

rainfall, and to have become fertile again. (Mr. Phipps gave many instances from the history of different lands—Spain, France, Germany, Palestine, India, and others bearing on this point.) The operations of nature, he said, are chiefly hidden from our view. We see the tree grow and the field yield its increase, but the actual accretion, particle by particle, so that the buds sprang forth, the leaves appeared, the blossom and the fruit followed in due season, is not within our sight. But we know that the sun gave its warming beams ; that the moisture continually rose from the earth at its call, and fell again in rain, and rose and fell again. And we know that when alternate heat has dried the land, and alternate shower has given its waters, till trunk and branches drip, and the roadside ditch is a flowing river, that then leaf and bud and blossom glow and swell with a newer beauty, that the great leaves of the cornfield broaden with a more vivid green, that the waving wheat receives growing impetus and overtops the rustic fence, and every embowering grove sends out a fresher fragrance upon the summer air. It is the enriching influence of the circulation of heat and moisture—it is with this we interfere when we deforest the land. In Ontario, in many parts, we have cleared all but ten per cent, and even this small amount is not remaining. How to preserve and increase it is the chief question for Ontario to-day, for on that alone depends whether her farms shall remain fertile or become barren. In the rest of the address, which was entirely impromptu, and of which this report is necessarily but a synopsis, Mr. Phipps narrated many interesting facts concerning the influence of deforesting on agriculture in Ontario, and stated that, in the older settled parts, there were but three ways of proceeding. By windbreak, by plantation, and by preserving whatever portions of forest yet stood, by excluding cattle, which last was the main point. He gave the methods of proceeding in each case, and mentioned the trees suitable for each. He also spoke of the large pine forests in the interior, the necessity of their preservation from fire, described the burnt lands he had lately seen near the Ottawa, where for a length of seventy miles, and a breath of twenty, in one place alone, was nothing but dead trees, useless now, a pine forest worth many millions a few years back, and mentioned that Quebec was reserving great areas for forest alone, discouraging settlement wherever the pine forest should be preserved. He concluded by saying that it was much more than a Provincial, it was more than a national,

more than a moral question, it was an object which should be impressed upon us by the highest feelings of our religion. We found here the wood, the water, the fertile soil. We know that the deforesting of a country does more than remove the one, it greatly impairs the others, so that the land may not be able to support more than the tenth part it now maintains. We should remember that no proprietor can have a title to destroy the fertility of the soil, lest "the field cry out against him, and the furrows thereof likewise complain." The vast concourse of humanity continually emerges from the unknown past, it travels toilsomely by, it is lost in the clouds of the future. Be sure that there we shall meet with strict questioners; nor will those pass unchallenged who have, to serve their own purposes, rendered painful, sterile, and barren, the path of generations yet to follow.

Mr. Browning asked if the Government was taking any action in the direction suggested.

Mr. Phipps replied that several reports on the subject were made at the instance of the Government.

Mr. Macdougall spoke of Forestry Associations in the North-west, in Australia, and in India, whose work had produced beneficial results.

Mr. Murray considered the subject as one of great importance to this country, and suggested that cattle should not be allowed to pasture on forest land, as when they do so pasture they prevent second growth.

Mr. Bain and Mr. Livingstone made some remarks, and the President illustrated on the blackboard the difference between trees grown in the forest and in the open field.

THIRTEENTH ORDINARY MEETING.

The Thirteenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, February 7th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

Neil McEachren, Esq., B. A., was elected a member of the Institute.

The following list of donations and exchanges was read :

1. The Canadian Practitioner, Vol. X., No. 2, for February, 1885.
2. Science, Vol. V., No. 104, for January 30th, 1885.
3. American Journal of Science for February, 1885.
4. Journal of the New York Microscopical Society, Vol. I., No. 1, for January, 1885.
5. Harvard University Bulletin, Vol. IV., No. 1, for January, 1885.
6. Transactions of the American Society of Civil Engineers for November, 1884.
7. Transactions of the Connecticut Academy of Arts and Sciences, Vol. VI., Part 1.
8. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Sitzungen vom 17 Mar', vom 22 Jan., vom 19 Jul, 1884.
9. Correspondenz-Blatt der Deutschen Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, XV,, Jahrgang, No. 11 u 12, November und Dezember, 1884.

Mr. Ernest E. T. Seton read a paper on "The Ruminants of the North-West," in which a brief account was given of the following twelve Ruminants :—

1. Common Virginian Deer..... *Cervus virginianus.*
2. Mule Deer or Jumping Deer..... " *macrotis.*
3. Woodland Caribou or Reindeer... " *tarandus.*
4. Barren Ground Caribou..... " *arcticus.*
5. Elk or Wapiti..... " *canadensis.*
6. Moose..... " *alces.*
7. Antelope or Cabri..... *Antilocapra americana.*
8. Rocky Mountain Goat..... *Magama montana.*
9. Rocky Mountain Sheep or Bighorn. *Ovis montana.*
10. Musk Ox..... *Ovibos moschatus.*
11. Prairie Buffalo..... *Bison americanus.*
12. Wood Buffalo..... " " *var ?*

Original observations on each of these were brought forward, together with many facts relative to their economic value and preservation of the species. The last named had never before been described by scientists, therefore Mr. Seton's account of it is given in full.

THE WOOD BUFFALO.

(*Bison americanus, var?*)

The present is very closely related to the Prairie Buffalo. The majority of writers either hold them to be identical, or ignore this variety altogether; but this is owing chiefly to the lack of information regarding the animal, for, curiously enough, this the largest land mammal in America, is among those of which the very least is known.

The information which is here presented, is gathered from Captain Butler's narrative, and from the lips of two northern hunters, Elzear Mignault, who spent twelve years (1863-'75) on the Peace River, in the service of the Hudson's Bay Co., and Mr. K. N. L. Macdonald, a Winnipeg gentleman, who, for ten years, hunted on the upper Mackenzie. The accounts of the two latter agree in all important points, except that Mr. Macdonald considers the Wood Buffalo a mere variety of the prairie animal, while Mignault, whose experience is much greater, maintains, with the Indians, that it is distinct; urging also, in support of his opinion, that the last Prairie Buffalo ever seen in the valley, was killed in 1866. It was a solitary, mangy bull, a complete outcast, and this needed not to have been his condition had the Wood Buffaloes been his immediate kindred.

All my informants agree that the Wood Buffalo differs, chiefly, from its prairie relative in being much larger, and considerably darker in color. Mignault adds that its legs are proportionately *shorter*, its horns less robust and more curved inwards, its hair is shorter, finer, entirely without curl, and all over of a very dark brown—almost a black in winter,—but in summer assuming a hue similar to that of the prairie animal.

Capt. Butler, who traversed the Peace River valley in 1870, wrote as follows: "But, although, the Moose are still as numerous on Peace River as they were in days far removed from the present there is another animal which has almost wholly disappeared."

The giant form of the Wood Buffalo no longer darkens the steep, lofty shores. When first Mackenzie beheld the long reaches of the river, the "gentle lawns," which alternated with "abrupt precipices," were "enlivened" by vast herds of buffaloes. This was in 1793. Thirty-three years later, Sir George Simpson also ascended the river with his matchless Iroquois crew, yet no Buffalo darkened the lofty shores.

What destroyed them in that short interval? The answer is not difficult to seek—deep snow! The buffalo grazes on the grass, the moose browses on the tall willows. During one winter of exceptionally deep snow, eighty buffaloes were killed in a single day in the vicinity of Dunvegan. The Indians ran them into the snow-drifts, and then despatched them with knives.

It is still a matter of dispute whether the Wood Buffalo is the same species as his namesake of the southern plains; but, it is generally believed by the Indians that he is of a kindred race. He is, nevertheless, larger, darker and wilder; and, although the northern land in which he is still found abounds in open prairies and small plains, he, nevertheless, seeks in preference the thickest woods. Whether he be of the plain race or not, one thing is certain,—his habits vary much from his southern cousin. The range of the Wood Buffalo is much farther north than is generally believed. There are scattered herds, even now, on the banks of the Liard River, as far as sixty-one degrees of north latitude.

When Mignault left the Peace River in 1875, the Wood Buffalo were plentiful in the country between Dunvegan and Great Slave Lake, and the Liard and Arthabasca Rivers. In 1884, he heard from a comrade, that they were then still common.

The Indians, he said, call it *Ah-thuk-ard Moos-toosh*, and consider it quite distinct from the Prairie Buffalo, which they call *Mas-Kootay Moos-toosh.*

Its general habits differ a good deal from those of its prairie relative, rather resembling those of the Moose, although it is much less wary and difficult to approach than that animal.

It is rarely found in herds, except in the fall. The greatest number my informant ever saw together was three. These were going down to the river, as he rounded a point in a barge. As soon as he came in view, they scrambled up the bank and disappeared in the woods. But in the month of October, the mating season, they are inclined to gather into straggling bands of both sexes, and go roaming about the woods, which are made to resound continually with the thud and trampling of the males engaged in battle.

During the winter they confine themselves to the heaviest and densest timber, subsisting on willow scrub, moss, and such dry grass as is attainable. In the summer they are so much persecuted by the bull-dog flies, that they spend the greater part of warm days

immersed to the eyes in some lake or mud hole. and it is not an uncommon sight for the voyageur, who silently rounds some point on the Liard, Salt or Peace River, to observe, protruding from the water, the great black head of the buffalo, who, gazing stupidly for an instant, then suddenly bestirring himself, plunges to the shore and disappears among the trees. They feed in the night, the only time they are free from the torment of the gad flies. They seek the thick swamps from preference, but distinguish and avoid the treacherous bogs or *muskegs*, which are found in various parts of the country.

My informant thinks that they frequent the dense woods in summer, chiefly to escape the persecutions of the gad-flies; for, when the day chances to be so cold and windy that not a fly is to be seen, they take advantage of the opportunity to climb about even the high, rocky hills.

The young are produced sometime in June, usually one, but occasionally two at a birth. Concerning their color, development and growth, I have not been able to procure reliable information.

There is one other general observation that I would make in connection with the buffalo. In a previous paper, I brought forward reasons for believing that, within a very recent period, this prairie country was one continuous forest, and that fire had been the clearing agent. Where, then, it may be asked, were the Prairie Buffaloes in those forest days? I am inclined to think there were none, but that the sole bovine inhabitant of the country was the Wood Buffalo, and that the prairie animal is a recent specialization, which conforms in its change of form and habits to several precedents, wherein a wood animal has become smaller, lighter colored, and gregarious, on betaking itself to a life in the open country. As examples, I may cite the almost solitary giant Ure Ox of Cæsar's time, said to be the ancestor of our common cattle; the Prairie Wolf, doubtless very nearly akin to his larger brother of the timber; and the Barren Ground Caribou, which evidently was but recently differentiated from its larger, darker, and less gregarious woodland brother!

So far, I have not had an opportunity of examining the hide of the Wood Buffalo, though I learn that they are not esteemed great rarities, even among Fort Garry furs, yet, I hope that any reader who may have the opportunity of measuring or describing this

animal, or in any way adding to our knowledge of it, will not fail to avail himself of it, and thus render to Science most useful and valuable assistance.

Mr. Rouse suggested as a reason why the elks migrated to the north in winter the weakness of their horns, but this was doubted, because another species migrate the reverse way.

Mr Notman asked what became of their cast-off horns, to which it was answered that they were eaten by small rodents.

Mr. Shaw asked the name of the Oat referred to. Ans.—*Stipa spartica.*

Mr. Murray asked as to the fertility of hybrid deer, to which it was answered that they were all fertile.

The President remarked that the only domesticated American animal was the Llama.

FOURTEENTH ORDINARY MEETING.

The Fourteenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, February 14th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges was read :

1. Rules and Regulations of the Royal Society of Canada.
2. The Canadian Entomologist, Vol. XVI., No. 12, December 1884.
3. Science, Vol. V., No. 105, February 6th, 1885.
4. Appleton's Literary Bulletin, Vol. IV., No. 1.
5. Journal of the Franklin Institute for February, 1885.
6. Monthly Notices of the Royal Astronomical Society, Vol. XLV., No. 2, for December, 1884.
7. Transactions of the Royal Scottish Society of Arts, Vol. XI., Part 2.
8. Atti della Società Toscana di Scienze Naturali, Processi Verbali, Vol. IV.
9. Boletin de la Academia Nacional de Ciencias in Cordoba (Republica Argentina), Tomo VI., Entrega 4*a*.

Mr. W. J. Loudon, B.A., read a paper on "The Decimal System applied to Time," of which the following is an abstract :

The system of Time which I propose is the following: The ordinary day of twenty-four hours would be divided into ten periods called, if necessary, hours ; each hour in the new system thus corresponding to two hours and twenty-four minutes of ordinary time. This new hour would be divided into one hundred divisions (which we may term minutes) : each of the latter minutes being equivalent, therefore, to 1·44 minutes of present time, and being a sufficiently good working unit. For small measurements, this minute could be subdivided into one hundred seconds, each of the new seconds corresponding to ·864 of the old.

The advantages which I claim for the adoption of such a system are :—

1. All advantages arising from the use of a system based on our natural scale of ten. Instead of using separate symbols to denote hours, minutes, seconds, time would be denoted by a number and a decimal : thus, instead of saying and writing 2 hrs., 25 min., 30 sec., we would simply say and write 1·45. The labour saved in addition, subtraction, etc., would be incalculable. As a corresponding example of labour saved, I need only refer to the English system of pounds, shillings, pence, and farthings, when contrasted with our decimal system of dollars and cents.

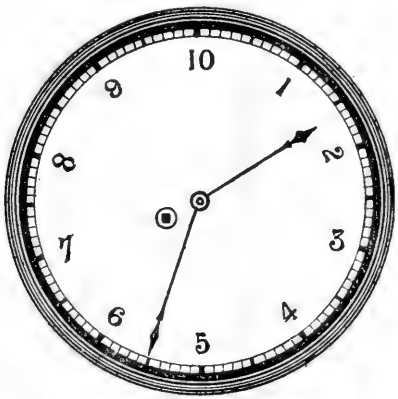
2. The abolition of the a.m. and p.m. nuisance. This has, of course, been overcome by the twenty-four hour scheme, but the latter is too unwieldy ever to come into common use.

3. The change in units, the hour becoming longer and the minute longer, than the present hour and minute.

4. The fact that the numbers on the face of the clock indicate the time at once. The greatest objection to our present system (if we omit the a.m. and p.m. distinction) is, that the time at any instant cannot be inferred by any simple process of the mind from the dial of the clock ; when the minute hand is at one, we say it is five minutes past ; when the minute hand is at eight, we say it is twenty minutes to ; when at eleven it is five minutes to, and so on. If we analyze the reasons for which children find so much difficulty in learning to tell time, we shall find the cause of all their trouble in

this strange arrangement of time measurement. Indeed, it is only after years of patient labour and mental struggle, that the majority of children succeed in fixing in their minds the meaning of the minute hand when in different places. Let anyone take the clock constructed in the manner I have indicated, and I will venture to say that any child can learn to tell the time from it in a few short lessons. I might go still further, and make the general statement that an enormous amount of mental labour is expended among ordinary people in looking at a clock or watch, and going through the struggle that is termed "telling the time."

The clock which I have constructed from an ordinary eight day clock, and which fulfils accurately the above conditions, as regards the hours and minutes, is represented in the Figure.



TIME 1·55.

Mr. Keys, referring to the clock on the decimal system by which the paper was illustrated, showed the ease with which the change could be made, viz., by the use of two additional wheels, and congratulated the Institute on the reading of this paper so soon after Sandford Fleming's, by which important changes were brought about.

Mr. Livingstone doubted whether the change could be made, because the human mind is not mathematical, but rather musical, running in 2's 3's and 4's.

The President approved of the change because we are committed to the decimal system of numeration, but thought

it a misfortune that the duodecimal system had not been adopted in the first instance.

FIFTEENTH ORDINARY MEETING.

The Fifteenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, February 21st, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges received since last meeting was read :

1. Monthly Weather Review, Dominion of Canada, for January, 1885.
2. Science, Vol. V., No. 106, February 13th, 1885.
3. Annual Report of the Board of Managers of the Buffalo Historical Society, January 13th, 1885.
4. Second Annual Report of the Board of Trustees of the Public Museum of the City of Milwaukee, October 1st, 1884.
5. Anthony's Photographic Bulletin, Vol XVI., No 1.
6. Proceedings of the Royal Geographical Society, Vol. VII., No. 2, February, 1885.
7. Notice Historique de l'Université de Bruxelles, 1834—1884, par L. Vanderkinden.
8. Bericht über die Senckenbergische Naturforschende Gesellschaft, vom Juni, 1883, bis Juni, 1884.
9. Fünfter Jahresbericht der Geographischen Gesellschaft zu Hannover, 1883-84.

Mr. Vandersmissen gave notice that at the next meeting of the Institute, he would move that a committee be appointed to consider in what way the work of the Institute could be carried on in sections.

Mr. Lennox read a paper on "The Fossil Sharks of the Devonian."

The subject of this paper was the fossil fin-spine of a shark, taken from the corniferous limestone, at St. Mary's, Ont. It belongs to the genus *Machæracanthus, Newberry.* This genus is distinguished from all other fossil fish-spines by not being bilaterally symmetrical. They have been found only in the corniferous of Ontario, New

York, and Ohio. The specimen in question, *M. sulcatus*, is ten and a-half inches in length, about an inch wide, and two-thirds of an inch deep. Its original length, however, may have been fourteen or fifteen inches. It is grooved longitudinally upon one side, smooth and keeled on the other.

Symmetrical spines like *Pleuracanthus* were, doubtless, implanted in the flesh, in front of the dorsal fins ; but the asymmetrical forms were, in all probability, imbedded in the integuments, before the pectoral fins.

Judging from pieces of shagreen found with the spines, and the total absence of traces of a long skeleton, we may fairly conclude that these were the defensive weapons of very large sharks, which must have been formidable indeed.

Mr. Dale mentioned a spine somewhat similar, which he had found in marl, in New Jersey, and drew attention to the mode of attachment of the spines, by which they were held erect.

Mr. Boyle having asked as to the traces of shagreen in the rocks at St. Mary's, Mr. Lennox replied that they were found in patches, five or six inches square.

Mr. Livingstone suggested a theory that the carboniferous had something to do with the destruction of these fish, and that coal was the result of solidification of coal oil.

Mr. Macdougall, Mr. Notman, and Mr. Murray, made some remarks, and the President noted the great interest of a discovery of remains of sharks at so remote a period.

SIXTEENTH ORDINARY MEETING.

The Sixteenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, February 28th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

It was moved by Mr. Vandersmissen, seconded by Dr. Kennedy, and resolved,—" That the following gentlemen be a

committee to consider the advisability of dividing the Institute into sections, in accordance with the suggestions contained in the President's Inaugural Address, and to report upon a scheme for that purpose if advisable: the President, the Secretary, Mr. Boyle, Mr. Geo. E. Shaw, Mr. J. M. Buchan, Mr. Alan Macdougall, Prof. Loudon, Mr. Murray, and the mover and seconder."

The following list of donations and exchanges was read:

1. The Canadian Entomologist, XVII., Nos. 1 and 2, January and February, 1885.
2. Science, Vol. V., No. 107, February 20th, 1885.
3. Journal of the New York Microscopical Society, Vol. I., No. 2, February, 1885.
4. Journal of the Anthropological Institute of Great Britain and Ireland, Vol. XIV., No. 3, February, 1885.
5. Boletin de la Academia de Ciencias in Cordoba (Republica Argentina), Tomo VII., Entrega 1*a*, 2*a*.
6. Annaes da Escola de Minas de Ouro Preto, No. 3., Rio de Janeiro, 1884.
7. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, 4*e* Sérié, 36*e* Année, 12*e* Cahiér, December, 1883, 4*e* Sérié, 37*e* Aunée 8*e*, et 9*e* Cahiér, Août et Septembre, 1884.
8. Les Annales des Mines :—

   Sêptieme Série, Mémoires, Tome XVI., 6*e* Livraison de 1879, Tomes XVII., XVIII., XIX., XX., 1880, 1881. Huitième Série, Mémoires, Tomes I., II., III., IV., V., Livraison 1*re* 2*e*, 3*e*, Tome VI., Livraison 4*e*, 5*e*, 1882, 1883, 1884. Lois Décrets, Arrêts, 1880, 1881, 1882, 1883. 7*e* Série, Tomes IX., X. 8*e* Série, Tomes I., II.
9. Proceedings of the Conference relating to a Prime Meridian, from the Dominion Government.

Mr. John Phillips read a paper on "The Centrifugal Forces of the Planets."

The object of the paper was to establish the proposition that the moon was projected vertically from the earth at an initial velocity of about seven miles a second, the earth and moon having originally formed a single mass. Mr. Phillips showed the process by which he determined the velocity with which a heavy body falling from a state of rest towards the earth from the distance of the moon would strike the earth's surface, this being also the initial velocity with which a body would have to be projected in order to ascend to that distance. Having exhibited the formulæ and substituted for the general terms the particular quantities as determined by observation,

he found this velocity to be 36,707 feet per second, or 253 feet less than seven miles. He then showed the effect upon a body so projected of the rotary motion of the earth, and of the perturbation caused by the sun's attraction, and how these forces combined would give such a body exactly the orbit in which the moon actually moves. Having also indicated how the permanency of the system is ensured, he deduced the conclusion as irresistible that this is how the moon was projected into her present orbit.

Mr. Livingstone took exception to some of the positions of the paper, and drew special attention to his doctrine that there is no such thing as centrifugal force at all, but that orbital motion is only vibration.

FIRST SERIES—Begun August, 1852; concluded December, 1855; 41 numbers, 3 vols. 4to.

SECOND SERIES—Begun January, 1856; concluded January, 1878; 92 numbers, 15 vols. 8vo.

THIRD SERIES—Begun 1879.

NOTES.

1.—The First Series has for title, "The Canadian Journal: a Repertory of Industry, Science and Art; and a Record of the Proceedings of the Canadian Institute." The Second series has for title, "The Canadian Journal of Science, Literature, and History." The title of the Third Series is, "Proceedings of the Canadian Institute." Parts 1 & 2, Third Series, are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

2.—By inadvertence, No. 85 (November, 1873) of the "Canadian Journal," 2nd Series (Vol. XIV.) immediately follows No. 79. There is, however, no *lacuna* between these two numbers, as is shown by the fact that the paging is consecutive.

3.—Societies wishing to exchange back numbers of their Proceedings can be supplied with complete sets of the Publications of the Canadian Institute, except Vol. XV., No. 5, Second Series, and Vol. I., Part 1, Third Series.

4.—Members having either of the above, Vol. XV., No. 5, Second Series, April, 1877, or Vol. I., Part 1, Third Series, 1879, and being willing to part with them, will please communicate with the Assistant Secretary.

CANADIAN INSTITUTE
ESTABLISHED 1849

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OF

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JUNE, 1886.

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1886.

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PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

SESSION 1885–86.

PRIMÆVAL DEXTERITY.

BY DANIEL WILSON, LL.D., F.R.S.E.,
President of University College, Toronto.

[The facts in reference to "The Bohemian Skull" (see *ante*, page 43) having since the reading of the paper been made public elsewhere, Dr. Wilson furnishes the following paper for publication in lieu of it.]

In a communication made to the Canadian Institute in 1871, and subsequently printed in the *Canadian Journal*,* I drew attention to an interesting discovery, supposed to indicate the traces of a left-handed workman of prehistoric times. The Rev. William Greenwell carried out a series of explorations of a number of flint-pits, known as Grimes' Graves, near Brandon, in Norfolk ; and in a communication to the Ethnological Society, of London, on the subject, he states that in clearing out one of the galleries excavated in the chalk by workmen of the remote Neolithic Age in order to procure flint nodules in a condition best adapted for the purpose of the flint tool-maker, it became apparent that, while the pits were still being worked, the roof of the gallery had given way and blocked up its whole width. The removal of this obstruction disclosed three recesses extending beyond the chalk's face at the end of the gallery, which had been excavated by the ancient miners. In front of two of those recesses lay picks made from the antlers of the red deer.

* *Canadian Journal*, N. S., Vol. XIII., p. 208.

They corresponded to other deer's-horn implements found in various parts of the shafts and galleries. But Canon Greenwell noted that, while in the case of the two implements specially observed by him, the handle of each lay towards the mouth of the gallery, the tines which formed the blades of the picks pointed towards each other, suggesting, as he conceived, that in all probability they had been used respectively by a right and a left-handed miner. The day's work over, the men had laid down their tools ready for the next day's work; meanwhile the roof fell in, and the picks were left undisturbed through all the intervening centuries, till the reopening of the gallery.

The circumstance, though worthy of note, among the other details recorded by an accurate observer, could not in itself be regarded as of great weight in its bearing on the general question of the origin or prevalence of right or left-handedness. But any evidence tending to throw light on the usage in prehistoric times has a significance and value in reference to the original and very general use of the right hand where special dexterity is required. The question of the reason for such preference was brought under the notice of Carlyle by painful experience near the close of his life. It was his sad misfortune, when he had reached the advanced age of seventy-five, to lose the use of his right hand. The period of life was too late to turn with any hope of success to the untrained left hand; and more than one entry in his journal refers to the irreparable loss. But one curious embodiment of the reflections suggested by this privation is thus recorded upwards of a year after experience had familiarized him with all that the loss involved :—" Curious to consider the institution of the Right Hand among universal mankind; probably the very oldest human institution that exists, indispensable to all human coöperation whatsoever. He that has seen three mowers, one of whom is left-handed, trying to work together, and how impossible it is, has witnessed the simplest form of an impossibility, which but for the distinction of a 'right hand,' would have pervaded all human things. Have often thought of all that,—never saw it so clearly as this morning while out walking, unslept and dreary enough in the windy sunshine. How old? Old! I wonder if there is any people barbarous enough not to have this distinction of hands; no human Cosmos possible to be even begun without it. Oldest Hebrews, &c., writing from right to left, are as familiar with the

world-old institution as we. Why that particular hand was chosen is a question not to be settled, not worth asking except as a kind of riddle; probably arose in fighting; most important to protect your heart and its adjacencies, and to carry the shield on that hand."

The reference to "oldest Hebrews" no doubt had in view what may be regarded as the earliest known statistics of left-handedness on record. The account given in the Book of Judges of the remarkable skill manifested by the left-handed Benjamite warriors is worthy of special note. Left-handedness, if not more prevalent among the tribe of Benjamin than in other Hebrew tribes, appears to have attracted such special attention that those who were noted for it were organized into a separate body of marksmen, renowned for their matchless skill with the sling, as well as for their general dexterity. Ehud, the son of Gera, the deliverer of his people from the servitude of Eglon, King of Moab, was a Benjamite, a man left-handed: and so, as he snatched from his right side the dagger with which he slew the Moabitish king, the motion of his left hand would not excite suspicion. But the very form of the record shows the attribute to be exceptional; and all the more so as occurring in the tribe whose name—*ben yamin*, the son of my right hand,—so specially marks the sense of dignity and honour associated with the right hand. Hence the reference to this select body of seven hundred skilled marksmen is due to the fact that their use of the left hand was at variance with the general practice of their tribe. Had any ancient left-handed people come under the observation of the historical nations whose records have come down to us, this reference to the left-handed Benjamites shows that the fact would have been noted; for the entire number of left-handed slingers barely amounted to 2·7 per cent. Out of twenty-six thousand Benjamites, as we are told, all warriors, there were seven hundred chosen men of the tribe, every one of whom was left-handed, and could sling stones at a hair's-breadth and not miss. Nearly the same relative number, viz., two per cent., is assigned by Professor Hyrtl, of Vienna, as the proportion of left-handed persons at the present day, as determined from observations made by him in one of the most civilized centres of modern Europe.

But some recent disclosures give promise of evidence derived from greatly more ancient records even than the Hebrew scriptures. Discoveries in the department of prehistoric archæology have greatly

extended our knowledge of the history of the human race; and have opened vistas through which we already look on many novel revelations such as, at no very distant period, it would have seemed folly to imagine possible. We are as yet but on the threshold of such disclosures, and only imperfectly interpret the new chronicle. But among those already suggested by its study, one subordinate illustration of attributes characteristic of primitive man appears to be the evidence that among the palæolithic workers in flint, and the singularly gifted draftsmen of Europe's Mammoth and Reindeer periods, a preferential use of the right hand prevailed nearly as much as in historic times. The remoteness of such evidence, and its manifest freedom from all the artificial influences of civilization, give it a special value in any attempt to determine the source of right-handedness. No human cosmos, as Carlyle says, can by any possibility be even begun without this distinction of hands; and yet the precise cause of the nearly universal preference of the right hand appears to elude alike the research of the historian and the investigations of the physiologist.

The classification of man, apart from all other animals, as a separate order of *Bimana*, though no longer accepted as one fulfilling the requirements of science, is an indication of the characteristic significance attached to the human hand. It is an organ so delicately fashioned, and, in the daily actions of life employed with such remarkable skill in all the multifarious requirements of the soldier and seaman, the skilled artizan, the needlewoman, the clerk, the surgeon, the artist, musician, &c., that the biologist was not unnaturally directed to it when in search of a typical basis of classification. By reason of its mobility and its articulated structure, it is specially adapted as an organ of touch; and the fine sense which education confers on it tends still further to widen the difference between the human hand and that of the ape. But also, whether solely as a result of education, or traceable to some organic difference, the delicacy of the sense of touch, and the manipulative skill and mobility of the right hand, in the majority of cases, is found so far to exceed that of the left that a term borrowed from the former expresses the general idea of dexterity. That education has largely extended the preferential use of the right hand is undoubted. That it has even tended to unduly displace the left hand from the exercise of its manipulative function, I fully believe. But so far as appears, in the preference

of one hand for the execution of many special operations, the choice seems, without any concerted action, to have been that of the right. Not that there are not many left-handed workmen, artificers and artists, often characterized by unusual skill; but, the farther investigation is carried, the more apparent it becomes that such cases present exceptional deviations from what seems to be the normal usage of humanity. If the source of this characteristic preference is referable to any peculiarity in the structure of the hand, or of related organs, it ought to be easily explicable. Thus far, indeed, notwithstanding much patient research, it remains unexplained. Yet if it be no more than an acquired habit produced by the necessities indispensable to combined action, it is scarcely conceivable that no left-handed nation should be found. It is in this aspect that the evidence of archæology has such special value. If, far behind oldest historic periods, in the prehistoric dawn, it can be shown that man appears to have manifested the same preference for the right hand which we know him to have done throughout the historic period, it will no longer be possible to question that it has its origin in some obscure organic source. Carlyle, looking to man in his primitive stage as preëminently a fighting animal, assigns the original distinction of hands, as others have done before him, to the necessarily passive shield-bearing hand, as contrasted with that of the sword. With the origin of combined action in war, a choice would have to be made as to the side on which the shield was to be carried, if men were to fight in phalanx.

That such a distinction did exist from remote times is proved by some of the oldest Egyptian and Etruscan paintings, by Assyrian sculptures, and some of the most archaic Greek vases. The right side was *ἐπὶ δόρυ*, the spear side, while the left was *ἐπ' ἀσπίδα*, the shield side. The familiar application of the terms in this sense is seen in Xenophon's "Anabasis," IV. iii. 26, *Καὶ παρήγγειλε τοῖς λοχαγοῖς κατ' ἐνωμοτίας ποιήσασθαι ἕκαστον τὸν ἑαυτοῦ λόχον, παρ' ἀσπίδας παραγαγόντας τὴν ἐνωμοτίαν ἐπὶ φάλαγγος*, "He ordered to draw up his century in squads of twenty-five, and post them in line to the left." And again, Anabasis, IV. iii. 20: *Τοῖς δὲ παρ' ἑαυτῷ παρήγγειλεν . . . . ἀναστρέψαντας ἐπὶ δόρυ, κ.τ.λ.*, "He ordered his own division, turning to the right," etc. Egyptian paintings, though older than the earliest Greek vases, are less reliable; for in the symmetrical arrangements of hieroglyphic paintings the groups of figures are

habitually reversed, right and left, looking toward a central line or point. Nevertheless the evidence of righthandedness is manifest. But the discoveries of recent years in the caves of the Dordogne, in Southern France; and subsequently in Belgium, Switzerland, and England, have familiarised us with drawings of vastly greater antiquity than the earliest examples of Egyptian art.

Two sources of evidence in reference to the dexterity of the men of prehistoric times can now be appealed to: 1st. Their flint implements, so abundant, and so widely diffused; and 2nd. The carvings and drawings of palæolithic man. Of those earliest traces of man's handiwork, the implements of the River-drift Period are at once the rudest and most primitive in character. They occur in vast numbers, among the rolled gravel of the ancient fresh-water, or river-drifts, which belong to what has received from the included implements the name of the *Palæolithic Period;* and if they are correctly assumed to represent the sole appliances of the man of the Drift Period, they indicate a singularly rude stage. In reality, however, the large, rude almond and tongue-shaped implements of flint are nearly imperishable; while trimmed flakes, small daggers or arrow heads, and other delicately fashioned flint implements—as well as any made of more perishable materials, such as shell, wood, or bone,—must have been fractured in the violence to which the rolled gravels were subjected, or would perish by natural decay. Nevertheless the Drift Folk and the primitive Troglodytes of Europe have transmitted examples of their industry and skill in sufficient number to enable us to turn them to account for the present purpose. Their mode of working is now well understood; for the process of the ancient arrow-maker is no lost art. It has been in use among many barbarous races: and is still practised by some of the Indian tribes of this continent, to whom it has doubtless been transmitted through successive generations from remote times. The modes of manufacture vary somewhat among different tribes: but they have been repeatedly witnessed and described by explorers who have watched the native arrow-maker at work; and his operations no longer present the difficulties which were long supposed to beset them. Among the rarer primitive implements are hammer-stones, oblong or rounded in shape, most generally with cavities worked in two faces, so as to admit of their being conveniently held between the finger and thumb. Implements of this class have been repeatedly recovered from the

French caves; an interesting example occurred among the objects embedded in the red cave-earth of Kents's Hole, Devonshire; and others, of different periods, usually quartzite pebbles, or nodules of flint, have been found in many localities. Some of them were probably used in breaking the larger bones to extract the marrow; but the battered edges of others show their contact with harder material. Similar hammer-stones occur in the Danish peat-mosses, in the Swiss lake dwellings, and on our own continent, among other remains of the arts of the aborigines.

The mode of fashioning the large, tongue-shaped implements and rude stone hatchets, which are among the most characteristic drift implements, it can scarcely be doubted, was by blows of a stone or flint hammer; as was obviously the case with some large flint or horn-stone implements recovered from the pits of the Flint Ridge, a silicious deposit of the carboniferous age, which extends through the State of Ohio, from Newark to New Lexington.* At various points along the ridge, funnel-shaped pits occur, varying from four or five to fifteen feet deep; and similar traces of ancient mining may be seen in other localities, as at Leavenworth, about three hundred miles below Cincinnati, where the grey flint, or chert, abounds, of which large implements are chiefly made. The sloping sides of the pits are in many cases covered with the fractured flints, some of them partially shaped as if for manufacture. The work in the quarry was, no doubt, the mere rough fashioning of the flint by the tool-makers, with a view to facility of transport, in many cases, to distant localities. But the finer manipulation, by means of which the carefully-finished arrow-heads, knives, lances, hoes, drills, scrapers, etc., were manufactured, was reserved for leisurely and patient skill. It is now known that the more delicate operations in the finishing of the flint implements were done by means of pressure with a horn or bone arrow-flaker; and not by blows with a chisel or hammer. Specimens of the arrow-flakers in use by the American Indian and the Eskimo workers in flint are familiar to us. Different forms of those instruments are engraved among the illustrations to "The Ancient Stone Implements, Weapons, and Ornaments of Great Britain;"† and Dr. Evans describes the mode of using them as witnessed by Sir Edward Belcher among the Eskimo of Cape

* Prehistoric Man, 3rd Ed., i. 70, Figs. 5, 6 and 7.

† Evans' Stone Implements, Figs. 8, 9, 10.

Lisburne, and quotes accounts of methods pursued among the native Mexicans, and the Shasta Indians of California. Another, and in some respects more minute description of the process, in use by the Wintoon Indians, is furnished by Mr. B. B. Redding, in the *American Naturalist*, from his own personal observation. The artificer was Consolulu, the aged chief of the Wintoon Indians, and the material, as among the Shasta Indians, was obsidian; but the process is equally applicable to flint; the cleavage of which is nearly similar. His implements consisted of a deer-horn prong split lengthwise, four inches long, and half an inch thick, with the semicircular ends at right angles; two deer-horn prongs, one smaller than the other, with the ends ground down nearly to the shape of a square sharp-pointed file; and a piece of well-tanned buckskin. thick, soft, and pliable. Laying, as we are told, a lump of obsidian, about a pound in weight, in the palm of the left hand, he placed between the first and second fingers of the same hand the semi-cylindrical deer-horn implement, so that the straight side of one of the ends rested about a quarter of an inch from the edge of the block of obsidian With a small waterworn stone, in his right hand, he struck the other end of the prong, and a flake of obsidian was severed well adapted for the arrow-head. On the buckskin, in the palm of his left hand, he laid the obsidian flake, which he held in place by the first three fingers of that hand, and then took such a position on the ground that the left elbow could rest on the left knee and obtain a firm support. Holding in his right hand the larger of the two pointed prongs, and resting his thumb on the side of his left hand to serve as a fulcrum, he brought the point of the prong about one-eighth of an inch within the edge of the flake; and then, exerting a firm downward pressure, fragment after fragment was broken off until the edge of the arrow was made straight. As all the chips came off the lower edge, the cutting edge was not yet in the centre of the side. But the arrow-maker rubbed the side of the prong repeatedly over the sharp edge, turned over the flake, and, resuming the chipping as before, brought the cutting edge to the centre. In a similar manner, the other side and the concave base of the arrow-head were finished. The formation of indentations near the base for the retention of the tendons to bind the arrow-head securely to the shaft, apparently the most difficult process, was in reality the easiest. The point of the arrow-head was held between the thumb and finger of the left hand,

while the base rested on the buckskin cushion in the palm. The point of the smaller deer-horn prong, not exceeding one-sixteenth of an inch square, was brought to bear on the part of the side where the notch should be; a sawing motion made the chips fly to right and left, and in less than a minute it was cut to the necessary depth. The other side was then completed in like manner, and the arrow-head was finished in about forty minutes.

In the above narrative the use of the right hand in all the active manipulations of the Indian arrow-maker is assumed; though probably with no conscious purpose of emphasising what is the ordinary and normal practice. But the details are in other respects full of interest from the light we may assume them to throw on the method pursued by the primitive implement makers of the earliest stone age. Dr. Evans describes and figures a class of flint tools recovered from time to time, the edges of which, blunted and worn at both ends, suggest to his experienced eye their probable use for chipping out arrow-heads and other small implements of flint, somewhat in the fashion detailed above with the tool of deer's horn; and which we may, perhaps, presume were used before the discovery of the greater aptitude of horn or bone tools for the object in view. Some of the flint-flakers are carefully wrought into the form best adapted for being held in the hand of the workman. But whether fashioned by means of flint or horn fabricator, the material to be operated upon has to be held in one hand, while the tool is dexterously manipulated with the other. Signor Craveri, whose long residence in Mexico gave him very favourable opportunities for observing the process of the native workers in obsidian, remarks that, when the Indians "wish to make an arrow or other instrument of a splinter of obsidian, they take the piece in the left hand, and hold grasped in the other a small goat's horn. They set this piece of obsidian upon the horn, and dexterously pressing it against the point of it, while they give the horn a gentle movement from right to left, and up and down, they disengage from it frequent chips; and in this way obtain the desired form."* Again, in an account communicated to Sir Charles Lyell by Mr. Cabot, of the mode of procedure of the Shasta Indian arrow-makers, after describing the detachment of a piece from the obsidian pebble with the help of an agate chisel, he thus proceeds: "Holding the

* Translated from Gastaldi. See Evans' Stone Implements, p. 36.

piece against the anvil with thumb and finger of his left hand, he commenced a series of blows, every one of which chipped off fragments of the brittle substance." The patient artificer worked upwards of an hour before he succeeded in producing a perfect arrow head. His ingenious skill excited the admiration of the spectator, who adds the statement that, among the Indians of California, arrow-making is a distinct profession, in which few attain excellence.

In the various narratives, as will be seen, right-handedness is not only assumed as the normal, but as the invariable characteristic of the worker in obsidian or flint. But an ingenious investigator, Mr. F. H. Cushing, of the Smithsonian Institution, while engaged in a series of tentative experiments to determine the process of working in flint and obsidian, had his attention accidentally called to the fact that the primitive implements of the Stone Age perpetuate for us a record of the use of one or the other hand in their manufacture. With the instinctive zeal of youthful enthusiasm, Mr. Cushing, while still a boy, on his father's farm in Western New York, carried out a series of flint workings with a view to ascertain for himself the process by which the ancient arrow-makers fashioned the flint implements that then excited his interest. In his various attempts he aimed at placing hinself in the same conditions as the primitive manufacturer of Europe's Stone Age, or of the ancient Mound Builders of this Continent, devoid of metallic tools, and with the flint, obsidian, jasper, or hornstone, as the most available material out of which to fashion nearly all needful implements. He set to work accordingly with no other appliances than such sticks, and variously shaped stones, as could be found on the banks of the streams where he sought his materials. The results realize to us, in a highly interesting way, the earliest stages in the training of the self-taught workman of the Palæolithic Age. After making various implements akin to the most rudely fashioned examples from the river-drift or the old flint pits, by means of chipping one flint or stone with another, he satisfied himself that no amount of chipping, however carefully practised, would produce surfaces like the best of those which he was trying to imitate. He accordingly assumed that there must be some other process unknown to him. By chance he tried pressure with the point of a stick, instead of chipping with a stone, and the mystery was solved. He had hit on the method in use by Aztecs, Eskimos, and Red Indians; and found that he could

fashion the fractured flint or obsidian into nearly any shape that he desired.

I have recently learned from Mr. Cushing, that the instrument employed by him in some of those experiments was the same which Dr. John Evans informs me he accidentally hit upon in his earliest successful efforts at flint arrow-making, viz., a tooth-brush handle. In thus employing a bone or horn flaker, the sharp edge of the flake cuts slightly into the bone; and when the latter is twisted suddenly upward, a small scale flies off at the point of pressure in a direction which can be foreseen and controlled. With this discovery the essential process of arrow-making had been mastered. Spear and arrow-heads could be flaked with the most delicate precision, with no such liability to fracture as leads to constant failure in any attempt to chip even the larger and ruder spear or axe-heads into shape. The hammer-stone only suffices for breaking off a flake from the rough flint nodule, and trimming it roughly into the required form, preparatory to the delicate manipulation of edging, pointing, and notching the arrow-head. The thinning of the flint-blade is effected by detaching long thin scales or flakes from the surface by using the flaker like a chisel and striking it a succession of blows with a hammer-stone. The marks of this surface-flaking are abundantly manifest on the highly-finished Danish knives, daggers, and large spear-heads, as well as upon most other flint implements of Europe's Neolithic Age. The large spear and tongue-shaped implements of the drift are, on the contrary, rudely chipped, evidently by the blows of a hammer-stone; although some of the drift implements seem to indicate that the use of the flint or bone flaker was not unknown to the men of the Palæolithic Age. But the chipping-stone or hammer was in constant use at the later period; and small hammer-stones with indentations on the sides for the finger and thumb, and with their rounded edges marked with the evidence of long use in chipping the flint nodules into the desired forms, abound both in Europe and America, wherever the arrow-maker has carried on his primitive art. The implements in use varied with the available material. A T-shaped wooden flaker sufficed for the Aztecs in shaping the easily worked obsidian. The jasper, chalcedony, and quartz, in like manner, yield readily to the pressure of a slender flaker of horn; whereas Mr. Cushing notes that the "tough horn-stone of Western Arctic America could not be flaked by pressure in

the hand, but must be rested against some solid substance, and flaked by means of an instrument, the handle of which fitted the palm like that of an umbrella, enabling the operator to exert a pressure against the substance to be chipped nearly equal to the weight of the body." One result of Mr. Cushing's experiments in arrow-making was to satisfy him that the greatest difficulty was to make long narrow surface-flakes. Hence, contrary to all preconceived ideas, it is easier to form the much-prized delicately finished small arrow-heads, with barbs and stem, than larger and seemingly ruder implements which involve much surface-flaking.

It is interesting to learn of the recovery of what was supposed to be the lost art of the ancient arrow-makers by a series of tentative experiments independently pursued by different observers; and to find the newly-discovered process confirmed by the methods still in use by widely-scattered aboriginal tribes. So far the results of Mr. Cushing's experiments agree with those of other observers; but in the course of his operations he also noted this fact that the grooves produced by the flaking of the flint, or obsidian, all turned in one direction. This proved to be due to the constant use of his right hand. The first procedure is to strike off a suitable flake from the block of flint. This is then trimmed roughly with a hammer-stone into a leaf-shape, which is reduced in thickness by scaling off surface flakes with repeated blows upon the edge. Then comes the delicate process of finishing, pointing, and notching the arrow or lance-head with the bone flaker. Surface-flaking, or the thinning of the flint blade by the detachment of flakes running from the edge to the centre, is the most difficult part of the process. The method employed to effect this, by direct blows with a hammer stone, by pressure with a wood or bone flaker, or by combining the two, and using the bone or stone flaker as a chisel, can always be detected. Each method leaves its traces on the finished implement; and in the extreme cases of the rudely chipped flint implements of the drift, and the highly finished flint daggers and axes of the Danish mosses and shell-heaps, the contrast is very striking. Mr. Cushing also notes that in flaking a large arrow or spear-head in the hand it is necessary to hold it alternately by the point and by the base. As the grasp by the base is much firmer the pressure is greater; and hence the flakes scale off further toward or over the centre. As this unavoidably happens on opposite edges, a twisted and at times

a distinctly bevelled point is the result; especially when the material worked upon is unusually hard. This accounts for the bevelled type of arrow and spear-head of comparatively common occurrence, and which has been assumed by some to be designed for the same end as the rifling of a musket; but as the bevel or twist appears to be almost invariably in the same direction, Mr. Cushing arrived at the conclusion that the aboriginal arrow-makers were, like ourselves, a right-handed people. But if so, there were exceptions to the rule then as now. When the flaker is held in the left hand, so that the direction of pressure by the bone or stick is reversed, the result is apparent in the opposite direction of the grooves. So far as his observations extended, he occasionally found an arrow-head or other primitive stone implement with the flake grooves running from left to right, showing, as he believed, the manipulations of a left-handed workman; but, from the rarity of their occurrence, it might be assumed that, as a rule, prehistoric man was right-handed. When the results of those investigations into the arts of the Stone Age were reported at a meeting of the Anthropological Society of Washington, in May, 1879, Professor Mason confirmed from his own observation the occurrence of flint implements indicating by the reversed direction of the bevelling that they were produced by left-handed workmen. Mr. Cushing further notes that "arrow-making is accompanied by great fatigue and profuse perspiration. It has a prostrating effect upon the nervous system, which shows itself again in the direction of fracture. The first fruits of the workman's labour, while still fresh and vigorous, can be distinguished from the implements produced after he had become exhausted at his task; and it is thus noteworthy that on an unimpressible substance like flint even the moods and passions of long-forgotten centuries may be found thus traced and recorded."

The evidence thus appealed to is equally applicable to modern as to ancient workers in flint; and should a sufficient number of observers consider the question of sufficient importance to induce them to examine and report on the relative number of examples of what are thus assumed to be the result of left-handed manipulation, it is obvious that the class of implements referred to offers a trustworthy source of evidence whereby to arrive at an estimate of the prevalent use of one or the other hand among uncultured races alike in ancient and modern times.

When engaged in some more general inquiries into the evidence of the preferential use of the right hand among modern savage races, I appealed to the experience of my friend Dr. John Rae, who, like myself, is inveterately left-handed, to ascertain if he had noted any such habit among the Eskimos, or among the Indian tribes bordering on the Hudson's Bay, among whom he long resided. In his reply he informs me that, without having taken particular notice of Indian or Eskimo preference for one or other hand, he observed that some among the latter were markedly ambi-dextrous. But, he adds, "from a curious story told me by an Eskimo about a bear throwing a large piece of ice at the head of a walrus; and telling me, as a noteworthy fact, that he threw it with the left forepaw, as if it were something unusual, it would seem to indicate that left-handedness was not very common among the Eskimos."

So far as Mr. Cushing's observations and experiments supply any satisfactory basis for the determination of the question as to the general prevalence of right-handedness, they point unmistakably to such a conclusion, and he definitely advances the opinion that, with few and rare exceptions, primitive man was right-handed. The evidence thus far adduced is insufficient for an absolute determination of the question; but any strongly-marked examples of the left-handed workman's art among palæolithic flint implements appear to be exceptional. No higher authority than Dr. John Evans can be appealed to in reference to the manipulations of the primitive flint-worker, and, in writing to me on the subject, he remarks: "I think that there is some evidence of the flint-workers of old having been right-handed: the particular twist, both in some palæolithic implements, as in one in my own possession, from Hoxne, in Suffolk, and in some American rifled arrow-heads, being due to the manner of chipping, and being most in accordance with their being held in the left hand and chipped with the right." In the detailed description, given in his "Ancient Stone Implements of Great Britain," of the Hoxne example above referred to, he remarks: "It presents the peculiarity, which is by no means uncommon in ovate implements, of having the side edges not in one plane, but forming a sort of ogee curve. In this instance the blade is twisted to such an extent, that a line drawn through the two edges near the point is at an angle of at least 45° to a line through the edges at the broadest part of the implement. I think," he adds, "that this twisting of the edges was

not in this case intended to serve any particular purpose, but was rather the accidental result of the method pursued in chipping the flint into its present form."* A similar curvature is seen in a long-pointed implement from Reculver, in the collection of Mr. J. Brent, F.S.A., and again in another large example of this class, from Hoxne, presented to the Society of Antiquaries of London, upwards of eighty years ago. This, as Dr. Evans notes, exhibits the same peculiarity of the twisting of the edges so markedly, and indeed so closely resembles the specimen in his own collection, that they might have been made by the same hand. Of another example, from Santon Downham, near Hetford, Suffolk, almond-shaped, and with dendritic markings in evidence of iis palæolithic date, Dr. Evans remarks: "It is fairly symmetrical in contour, with an edge all round, which is somewhat blunted at the base. This edge, however, is not in one plane, but considerably curved, so that when seen sideways it forms an ogee curve;" and he adds: "I have other implements of the same, and of more pointed forms, with similarly curved edges, both from France, and other parts of England, but whether this curvature was intentional it is impossible to say. In some cases it is so marked that it can hardly be the result of accident; and the curve is, so far as I have observed, almost without exception ς, and not ϛ. If not intentional, the form may be the result of all the blows by which the implement was finally chipped out having been given on the one face on one side, and on the opposite on the other."† In other words, the implement-maker worked throughout with the flaker in the same hand; and that hand, with very rare exceptions, appears to have been the right hand. The evidence adduced manifestly points to the predominance of right-handed men among the palæolithic flint-workers. For if the flint-arrow maker, working apart, and with no motive suggested by the necessity of accommodating himself to a neighbouring workman, has habitually used the right hand from remote palæolithic times, it only remains to determine the cause of a practice too nearly invariable to have been the result of accident.

Unless there be some organic cause for the preference of one hand rather than the other, no systematic use of either hand would be likely to manifest itself in rude states of society where there is little

* Ancient Stone Implements, p. 520.
† Ancient Stone Implements, p. 501.

or no call for combined action. Hence a Stone Age is one where traces of it were least likely to occur. But the attention of archæologists and geologists had not been long directed to the extremely rude implements of the drift and the ancient caves, when the disclosures of the latter showed that the art of palæolithic man was by no means limited to operations in flint and stone. Contemporary specimens of carvings in bone and ivory have been preserved, securely sealed up in the cave-breccia, including daggers and lances of deers-horn and maces or batons of the same material, all decorated with more or less artistic skill. Other remains of the ancient workmen still more strikingly illustrate their æsthetic taste, and at the same time serve to throw light on the prevalence of right or left-handedness among the skilled artificers of Palæolithic or Neolithic Ages; as well as on the more important question of the intellectual development of primitive man. Within the last twenty years repeated discoveries in ancient cave-dwellings and retreats of Europe, and especially in those of southern France, have familiarized us with numerous specimens of the work of skilled draftsmen of Palæolithic Europe. The evidence they afford of the dexterity which these cave-men displayed in sketching and engraving on slate, horn, and ivory has been very widely recognized; but my attention was first directed to the possible clue which they might furnish to the prevalent use of one or other hand in that remote age, by what, on further investigation, proved to be an error in the reproduction of the famous drawing of the Mammoth on a plate of its own ivory, found in the Madelaine Cave, in the Valley of the Vézère. In M. Louis Figuier's "L'Homme Primitif," for example, which might be assumed as a reliable authority in reference to the illustrative examples of French palæolithic art, the La Madelaine Cave sketch is incorrectly reproduced as a left-hand drawing; that is to say, the mammoth is looking to the right. The direction of an unpremeditated profile sketch is a nearly unerring test of right or left-handedness. The skilled artist can, no doubt, execute a right or left profile at will; but in the ordinary use of the pencil a profile drawing, if done by a right-handed draftsman, will be represented looking to the left; as, if it is the work of a left-handed draftsman, it will certainly look to the right.

The drawings of the ancient cave-men of Europe have naturally attracted much attention. They are referable, beyond all dispute, to a period of long duration, when the mammoth and woolly rhinoc-

eros, the fossil horse, the Irish elk, the cave-bear, cave-lion, and cave-hyæna, with other extinct fauna, were to be found immediately to the north of the Pyrenees, along with the musk-sheep, the reindeer, and other Arctic mammals. The evidence of remote antiquity of the period marked by this extinct fauna, is of so comprehensive a character that it may be assumed to have now received universal acceptance. Any indications, therefore, of special intellectual capacity, such as the carvings and drawings of the cave-men reveal, are of special significance.

These examples of primitive art are of varying degrees of merit. Some may be compared with the first efforts of any untutored youth; while others, such as the La Madelaine mammoth and the grazing reindeer from the Kesserloch, furnish evidence of the observant eye and the practised hand of the skilled draftsman. Among a series of fanciful illustrations introduced by M. Louis Figuier in his "L'Homme Primitif," is a group of artists of the Reindeer epoch at work. Three men of fine physique, slightly clad in skins, stand or recline in easy attitudes, sketching or carving as a modern artist might do in the lighter hours of his practice. One stands and sketches a deer with free hand on a piece of slate, which rests against a ledge of rock as his easel. Another, seated at his ease, traces a miniature device with, it may be, a pointed flint, on a slab of bone or ivory. The third is apparently carving or modelling a deer or other quadruped. All are, as a matter of course, represented with the stylus, graver, or modelling tool in the right hand; the question of possible left-handedness not having occurred to the modern draftsman.

On the assumption of the significance of the direction of the profile, as a test of right or left-handedness, the following is the result of its application to the evidence of this class thus far available. The mammoth-drawing from the La Madelaine cave; the bison, imperfect, showing only the hindquarters; and the ibex, on a reindeer-antler, from Laugerie Basse; the group of reindeer, from the Dordogne, two walking and one lying on its back; the cave bear of the Pyrenees, from the cave of Massat, in the department of Ariége; and another representing a hunter stalking the Urus, may all be regarded as right-hand drawings. But the horses from La Madelaine, engraved on reindeer-antler, specially noticeable for their large heads; the horse, from Creswell Crags; the ibex, with legs in the air; and,

above all, the remarkably spirited drawing of the reindeer grazing, from Thayngen in the Kesserloch—a sketch, marked by incident both in the action of the animal and its surroundings, suggestive of an actual study from nature;—all appear to be left-hand drawings.

The number of examples thus far adduced is obviously too small to admit of any general conclusion as to the relative use of the right or left hand being based on their evidence; but so far as it goes, it suggests a much larger percentage of left-handed draftsmen than is to be looked for on the assumption that right-handedness is the normal condition of man. It indicates, moreover, the importance of keeping in view the distinction between the preferential use of either hand by the cultured and skilled workman, or the artist, and its employment among rude, unskilled labourers engaged in such toil as may be readily accomplished by either hand. That the use of the left hand is transmitted from parent to child; and so, like other peculiarities, is to some extent hereditary, is undoubted. This has, therefore, to be kept in view in drawing any comprehensive deductions from a few examples confined to two or three localities. It may be that the skilled draftsman of the Vézère, or the gifted artist to whom we owe the Kesserloch drawing, belonged to a family, or possibly a tribe, among whom left-handedness prevailed to an unusual extent, along with an amount of skill and dexterity such as is frequently seen to accompany the instinctive use of the left hand. In such circumstances left-handedness would be apt to be developed not only hereditarily but by imitation. Yet even among those palæolithic draftsmen a preference for the right hand was evinced by the majority.

The more the subject is studied, the more it becomes manifest that education, with the stimulus furnished by the necessities arising from combined action, have much to do with a full development of right-handedness. There is considerable evidence in favour of the idea that in the majority of children, the bias leading to the preference for either hand is so slight that no greater effort would be required to develop the preferential use of the left than of the right hand. But with a certain number the use of the right hand is natural and instinctive. Others again are conscious of an equally strong impulse to use the left hand; and though education may control this, it cannot eradicate it. In any enquiry, therefore, into the degree of prevalence of right-handedness, and its instinctive, organic, or congen-

ital origin, the evidence derived from uncultured classes and races is most reliable. In the conditions of savage life, where combined action is rare, there is little to interfere with the independent action of each individual in following his own natural bias. But so soon as coöperation begins to exercise its restraining and constraining influences, a very slight bias, due probably to organic structure, will suffice to determine the preference for one hand over the other, and so to originate the prevalent law of dexterity. The results shown by the ancient drawings of Europe's cave-men perfectly accord with this. In that remote dawn every man did that which was right in his own eyes. Some handled their tools and drew with the left hand; a larger number used the right hand; but as yet no rule prevailed. In this, as in certain other respects, the arts and habits of that period belong to a chapter in the infancy of the race, when the law of dexterity, as well as other laws begot by habit, convenience, or mere prescriptive conventionality, had not yet found their place in that unwritten code to which a prompter obedience is rendered than to the most absolute of royal or imperial decrees.

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ETRURIA CAPTA.

BY JOHN CAMPBELL, M.A.

Professor in the Presbyterian College, Montreal, &c., &c.

Read January 16th, 1886.

I have the honour to report to the Institute, as one of the most important results of my studies in Hittite palæography, the solution of the Etruscan problem. It is unnecessary to occupy time with an account of the many inscriptions in the Etruscan character, and of the attempts that have been made to decipher them, as such information can be obtained from sources open to every reader. Let it suffice to say that thousands of inscriptions have been discovered, and that, up to the present time, no satisfactory translation has been made, even of the briefest.[1]

The original materials with which I intend principally to deal are the epitaphs contained in Lanzi's Saggio di Lingua Etrusca and the Eugubine Tables, so faithfully reproduced in the Atlas accompanying Professor Bréal's ingenious but most unsatisfying translation. Of the Tables, seven only, and a small portion of an eighth, are in the Etruscan character. The rest are written in the Roman alphabet, and are Umbrian. These Umbrian tables are being translated, and will shortly be presented to the world as the oldest Celtic document extant. The proof of my discovery is chiefly to be found in the rendering of the Etrusco-Eugubine inscription, which is authenticated by its internal historical unity, the perfect accordance of its grammatical construction and vocabulary with those of a well-known living language, and the harmony between it and the independent Umbrian record. The evidence afforded by the numerous sepulchral inscriptions is necessarily less convincing, as they are brief, consist largely of proper names, present few constructions, and are popular, not classical. But, inasmuch as they are more accessible and more

[1] Dr. W. Deecke, the leading Etruscologist of the day, claims only 34 words made out "with tolerable certainty," exclusive of proper names. Encycl. Brit. Art. Etruria.

widely known than the Eugubine Tables, I propose to commence my story of decipherment with them.

THE ETRUSCAN CHARACTERS.

The radical mistake of all who have sought to read the Etruscan inscriptions has been their acceptance of the assertion, hardly ever called in question, that the phonetic values of the characters are those of the Roman, Greek, or Phœnician letters, with which they correspond in form. Thus, we are treated to such combinations as *Siathlarnthu avils mealchlsc*, and others much more barbarous, which mean nothing in any language on the face of the earth. For this radical error classical writers are not responsible, for the words given as Etruscan by Varro, Festus, Hesychius, and others, bear no resemblance to the uncouth forms of Etruscan as now read.[2] The fault lies with the thirty or more complete bilingual inscriptions, some of which, whether accidentally or through ignorance on the part of the writer of the Latin letters, may easily be made to coincide. Of these, the most misleading is the first in Lanzi's Saggio, which reads in Latin *Lart. Caii Cavlias*, and, in corresponding Etruscan, *L. Cae. Cauliam.* If there be a real correspondence of phonetic characters, such as this example would seem to indicate, between the Etruscan and the Latin, the work of decipherment has been proved an impossibility by the labours of nearly three centuries.[3] I shall show shortly that there is no real coincidence of phonetic values, and that the apparent coincidences in form of character are partly accidental and partly the result of ignorance or a desire to assimilate on the part of the engraver of the Roman letters.

It is now generally agreed that the Etruscans were a Turanian people; the representations of their physical features, their arts and customs, tending all in that direction.[4] Now, while European

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[2] These are referred to on page 154.

[3] "E naturale l'immaginare che gl'ingegnosi Toscani abbiano preso cura d'illustrare il loro antico suolo, ma un forestiero vi ha fatto le più grandi fatiche, cioè l'inglese Tommaso Demstero. Prima di lui però l'aretino Attilio Alessi aveva posto la mano a questa messe, formato un alfabeto etrusco, e riportate delle iscrizioni fino dal secolo XVI." Pignotti, Storia della Toscana, lib. I., p. 88.

[4] By Turanian I mean neither Indo-European nor Semitic. Apart from the intruding Turks and the Tartars of southern Russia, the existing Turanian populations of Europe are the Ugrians, (Finns, Lapps, Esths, Magyars, etc.,) and the Basques. The Lydian origin of the Etruscans, in spite of the objections of Dionysius of Halicarnassus, has been generally accepted

Aryans adopted the Semitic alphabet, which had been borrowed from the Egyptian hieroglyphic system, we have no evidence that Turanian peoples ever did so. Granting that Semites and Turanians equally borrowed from the hieroglyphics of Egypt their phonographs, it does not follow that they assigned the same values to the hieroglyphics and their later attenuations or letters. The fact that the Hebrews took the hieroglyphics representing an ox, a house, a camel, and a door, to set forth the sounds A, B, G, and D, because these are the initials of aleph, beth, gimel, and daleth, the Hebrew words for ox, house, camel, and door, rather tends to make it probable that a Turanian people would assign to these characters the sounds of the initial letters or syllables of the words denoting the same things in their own language. I say letters *or syllables*, because, of the ancient systems of writing known to us, many, such as the Assyrian, Chaldean, Median, were syllabic, not alphabetic, and such originally was the Persian.[5] The late origin of the vowel points in the Semitic languages seems to indicate that their alphabets were at

on the joint testimony of Herodotus I. 94, Strabo V. 220, Tacitus Ann. I. iv. 55. See, however, on the other side Rawlinson's Herodotus, Book I., Essay 1. The labours of Professor Sayce and others have established beyond a doubt the early occupation of Lydia, Phrygia, Cappadocia, and other countries of Asia Minor by a Turanian Hittite people: The Monuments of the Hittites, Transactions of the Society of Biblical Archæology, Vol. VII., p. 248. Professor Sayce says, (p. 249), "The chief monuments of the class to which I refer (Hittite) are found carved upon the rocks at Boghaz Keui, supposed to represent the classical Pteria, and at Eyuk, both of which are situated on the eastern bank of the Halys, and in the line of the high road from Sardis to Armenia. Besides these, others are met with at Ghiaour-Kalessi, in Phrygia, near Frahtin, and on the summit of one of the mountains of the Bulghar Dagh, in Lykaonia; and above all at Karabel, on the road between Ephesus and Sardis." Such are the two pseudo-Sesostris sculptures in Lydia. Further on (p. 272), Professor Sayce remarks: "The remains fonnd by Dr. Schliemann, at Hissarlik, show no traces of Assyrian, Egyptian, or Phœnician influence, but they point unmistakably to Babylonian and Hittite influence." And on the same page: "It is also possible that the Lydian tradition recounted by Herodotus, which derived the Heraklid dynasty from Ninus, the son of Belus, was an echo of the fact that Sardis had once been in Hittite hands." The Lycian and Phrygian alphabets, which have been read in much the same way as the Etruscan, I include in my scheme of Turanian syllabaries.

[5] The cuneiform characters of Babylon, Nineveh, and Media, are accessible to the general reader in Lenormant and Chevalier's Ancient History of the East, vol. I., p. 436, *seq.* About 90 such characters are there represented, having such values as ba, bi, bu, ga, gi, gu, da, di, du, akh, ikh, ukh, li, lu, al, il, ul, &c. For the Persian, see vol. II., p. 122, where Lenormant says: "Originally, it was probably syllabic." The present Japanese syllabaries called Hiragana and Katakana, which superseded the old Corean about the end of the 9th century, represent each 47 syllables—the latter by the same number of modified Chinese characters, the former by about three hundred such characters. See Aston's Grammar of the Japanese Written Language, p. 8, *seq.* The following are among the syllables represented: ka, ki, ku, ke, ko, ta, chi, tsu, te, to, ma, mi, mu, me, mo. The Tamul alphabet is really a syllabary, but of a kind similar to the Semitic alphabets taken together with the vowel points, although in the case of the Tamul the vowel indicators are incorporated with the consonantal character.

first syllabaries, each character denoting the combined sound of a consonant and vowel. There is, of course, also a bare possibility that phonographs may be complex, representing words, as in the Egyptian, Assyrian, and Chinese, in which case they might receive the name of ideographs ; but in the case of the Etruscan characters this is hardly likely, as the hieroglyphic form has entirely disappeared from them. The problem, therefore, is to find the powers of that Turanian alphabet or syllabary, of which the Etruscan system of writing is one of the variant forms. An attempt to solve the problem necessitates a wide outlook, which shall embrace in comparative study all ancient Turanian methods of speech notation.

THE ANCIENT TURANIAN SYLLABARY.

For several years I have given the greater part of my leisure time to a solution of the problem thus presented, being stimulated thereto by the discovery of the Hittite tablets engraved in hieroglyphic characters at Hamath and Carchemish. These Hittite hieroglyphics, representing human, animal and other figures, like the Egyptian, but less conventionally, I take to be the originals of the Turanian alphabet or syllabary. With the exception of my own transliteration and translation, which is, I now find, very imperfect, these inscriptions have not been read, and are, therefore, unavailable as materials for interpretation in themselves.[6] But it has been shown by Professor Sayce and other students that the alphabetic characters found on Cyprian monuments bear a somewhat similar relation to the hieroglyphics of Syria to that which the hieratic bears to the Egyptian hieroglyphic.[7] The phonetic values of many Cypriote characters

The same is the case with the Corean and ancient Japanese. For the Corean alphabet and syllabary, see plate 1 of Atlas accompanying Klaproth's Translation of the San Kokf Tsou Ran To Sets, Oriental Translation Fund's Publications.

[6] A friendly critic suggests that my admission of great imperfections in the transliteration and translation of the Hittite inscriptions is not reassuring. Neither in that document nor elsewhere have I made any claim to infallibility ; nor, I trust, shall I ever fail to admit with becoming frankness the errors which are almost unavoidable in the pioneer work which has fallen to me. I do adhere firmly to my reading of the bilingual inscription of Tarkutimme, and of the names Shalmanezer, Sagara, Pisiris, Khintiel, Rezin, Hamath, Hittite, and many other words in the larger inscriptions. Some of the Hittite hieroglyphics I am still in doubt about. To others I find that I attached false phonetic values which I have since corrected. The majority of my identifications I have confirmed by subsequent extensive comparisons with materials not at first accessible to me.

[7] In an article on the Hamathite inscriptions in the Trans. Socy Bib. Archæol, Vol. V., p. 31 Professor Sayce says : "Some time ago I expressed the opinion in the Academy that this earlier system of writing was none other than the hieroglyphics of Hamath." The earlier

have been fixed by the labours of Messrs. Schmidt, Pierides and others, who show that their sounds have little correspondence with those expressed by similar Semito-European letters. Besides the Cypriote, the only other alphabet of like character, the powers of which are certainly known, is the Corean of far Eastern Asia, which furnished me with phonetic values of forms belonging to the Etruscan and other old Turanian syllabaries, as the Cypriote also had done. From Corea, my researches extended in two directions, the one westward towards Siberia, the other eastward to Japan and this continent. To take the Japanese first, I am indebted to the kindness of the Rev. John Edwards for the work of Ban Nobutomo on the ancient Japanese alphabet. This, as he and other Japanese grammarians are agreed, is none other than the Corean, although, in the various inscriptions, it presents many diverging forms. Crossing over to America, the only traces of aboriginal alphabetic writing known to me, which I accept as genuine, are the Grave Creek stone, a true copy of which I owe to Colonel Whittlesey, the Brush Creek stone, of which Mr. Hilder, of St. Louis, sent me a photograph, and the Davenport stones, for the knowledge of which I am indebted to the late Dr. Farquharson.[8] Each of these contains characters agreeing with the Corean; and the larger Davenport stone, by its semi-hieroglyphic forms, suggests a Hittite origin. The connection of the Mound Builders with the Aztec population of Mexico is conceded by many of the most scientific students of American antiquity. The

system alluded to is that from which the Cypriote syllabary was derived. Again (p. 32) he continues: "A comparison of the forms of the characters in the Cypriote syllabary with those of the Hamathite (Hittite) inscriptions seems to me to render it highly probable that both have the same source."

One of the earliest workers in the field of Cypriote Palæography is Professor Moritz Schmidt, of Jena. See his work "Die Inschrift von Idalion, und das kyprische Syllabar." Also many papers in the Trans. Soey. Bib. Archæol. on the subject by Dr. Birch, Dr. Paul Schrœder, Messrs. D. Pierides and I. N. Hall In Germany the names of Deecke, Siegismund, and Brandis, should be added to that of Schmidt. The Cypriote syllabary is accessible to most readers in Cesnola's "Salaminia," where the values are given.

[8] As there has been much controversy in the United States regarding these inscriptions I cannot allow this notice of them to pass without deprecating the tone of those who on *a priori* grounds have assailed their genuineness and cast aspersions of the most serious kind upon the characters of men whose only title to receive anything but respect at the hands of their fellows, was their being connected with the finding of the relics. See an able defence of the Davenport Academy of Natural Science in connection with the tablets by Mr. Charles E. Putnam: Elephant Pipes and Inscribed Tablets of the Mound Builders, Davenport, Iowa, 1885. I mean no disrespect to American scholarship when I say that there was not knowledge enough in the United States to forge these inscriptions. There are other so-called Mound Builder inscriptions besides those for which I vouch from internal evidence, of which I say nothing.

writing of the two peoples should also coincide. It is easier to trace the resemblance between the Corean characters and those of the Mound Builders than to show the relation of the latter to the Aztec hieroglyphics. I say Aztec rather than Mexican, for with the inscriptions of Yucatan and Guatemala we have nothing to do. Yet I am convinced that the Mound Builder characters are the cursive form of the Aztec hieroglyphics. Thus, starting from hieroglyphics, I ended at the same, embracing the only two hieroglyphic systems, excepting the Egyptian, in existence. On close examination I found that the hieroglyphics of Mexico stand in a very definite and intimate relation to those of Syria, spite of the wide interval between them in space and time.[9] As the phonetic syllabic values of the Aztec characters are well known, I gained in them the actual key to the old Turanian syllabary. The values of the Aztec hieroglyphics I found to correspond in almost every case with those which, on the authority of the Cypriote and the Corean alphabets, I had affixed to the characters, Etruscan and otherwise, most resembling them. Thus, for example, the Cypriote shield-like character having the power *mo*, and the Corean parallelogram possessing the same value, coincide with the square or circle, which in Aztec denotes the number 10, *matlactli*, and which in composition is read *ma*.

Passing now westward from Corea, a vast written area appears in Siberia. M. Vl. Youferoff, of the Imperial Society of Geography at St. Petersburg, spared himself no trouble to furnish me with the principal inscriptions found in the Yenisei country. These, with variations, set forth the same Turanian syllabary, rather of the Corean and Cypriote order than of the Aztec and Hittite.[10] Nevertheless, a few hieroglyphic forms, common to Hittite and Aztec, prominent among which is the *fish*, appear in these intensely interesting monuments. They also claim kindred with those of the American Mound Builders, as much by the correspondence of written characters as by the rude representations of animals and human figures which they contain. Several of them deal with the reign of Sekata, the Sheketang of the Chinese historians, who virtually headed the Khitan dynasty of China.[11] Searching for traces of the writers of

[9] See plate.

[10] The Hittite and Aztec are hieroglyphic; the Cypriote and Corean, cursive or alphabetical or syllabic in form.

[11] The Khitan dynasty of China, coming from the west, took possession of Leaotong in the north east in 907, and extended their sway over the northern part of the empire. From the

the Turanian character in the land of the Indian Cathaei, Dr. Emil Schlagintweit, of Munich, directed me to the Lat inscriptions of northern Hindostan. As I wrote the other day to Dr. Leitner, of Lahore, who is interested in my researches and has published my comparisons of inscriptions, it may seem presumptuous to ignore the labors of Prinsep, Cunningham, and Dowson in this field, who have acted on the supposition that the phonetic values of the Lat characters are those of corresponding early Sanscrit letters, and have published unsatisfactory translations of them.[12] Nevertheless, I am convinced that the Lat inscriptions are in the old Turanian syllabary, of which they are the most perfect specimens, as they are the first to exhibit the vowel notation which really makes them alphabetic like the Corean. The Corean vowel notation is the same virtually as that of the Lat inscriptions. To what extent the Aryan Indians borrowed the Turanian letters, or what phonetic uses they put them to, I am not yet in a position to say.

So far, I have found no links to bind the Punjab with Syria in the chain of Turanian script. From Syria westward, various mem-

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Khitan was derived the mediaeval name Cathay. They were expelled in 1125 and their place taken by the Mantchu Nyuche. Klaproth, Asia Polyglotta, 194. Sheketang or Shekingtang, the second Emperor of this dynasty, ascended the throne in 936 A.D., under the name of Howtsin. Gutzlaff's Sketch of Chinese History, Vol. I., p. 338. It is said that the invaders came from the desert of Kobi, but it is more than a coincidence that in the region of Siberia about the head waters of the Yenisei, where most of the Siberian inscriptions have been found, the natives call themselves individually *ket, kit, khitt, hitt, hüt,* according to their different tribes, and that one important tribe in former days, of which but a remnant is found, is that of the Kotten. Malte Brun, Geography, in loc., says that the Tartars call the mounds of the Yenisei country to which the inscriptions belong Li Katei, which he translates, "the tombs of the Cathayans."

[12] The first great student of the ancient characters called Lat (because chiefly found upon the monuments so denominated) was Mr. James Prinsep, the author of Indian Antiquities. The chief present workers in the same field are Major-General Alexander Cunningham, C.S.I., Director-General of the Archæological Survey of India, in his elaborate and valuable reports, and Professor Dowson, in the Transactions of the Asiatic Society and elsewhere. I call the translations given by these scholarly men unsatisfactory, because many of them are incomplete and can only furnish a general signification, a few present unwieldy compounds like Chehhichchha, and others represent pillars which eastern royalty might have envied as the gifts of mendicant monks. In the third volume of General Cunningham's admirable reports of the Archæological Survey of India, Plate XVI., inscription D is read on p. 48 in the text as "the religious gift of Bodhi Varmma, a mendicant priest of Sakya, &c." I read it as an invitation of a Gupta King to his people to worship Gatama. The construction is Japanese and of course the vocabulary is of the same nature. The Lat characters are of inestimable value in Turanian palæography as they, by means of added lines and curves to the radical consonantal character, as in the Corean, give definite vowel values. A careful study of the Indian inscriptions and more accurate knowledge of Japanese will enable me to read with greater precision and definiteness the Siberian inscriptions which are next to them in chronological order. For the Siberian Khitts and Chinese Khitan were but expatriated Indian Cathæi.

bers of this family appear. Besides the unmistakably Hittite hieroglyphics in Asia Minor, I find the Phrygian and Lycian inscriptions, figured in the works of Texier and others, to be Turanian. The same error, which has hid the Etruscan from view, has made these unintelligible. As at present read, with Greek and Phœnician phonetic values, they have no relations with any known tongue; and we have no right to suppose any family of language lost.[13] The bilingual Lycian inscriptions afford much help in determining the values of the characters, which exhibit Indian analogies. Although the aboriginal populations of Greece, including Macedonia and Thrace, were Turanian, I am not aware of any inscriptions in the old Turanian letters between Asia Minor and Italy. But, in the latter peninsula, it may almost be assumed that inscriptions, which are not written in Greek or Roman, are in Turanian characters. Such, most certainly, is the case with the Etruscan remains. The Etruscan letters are reproduced in Spain in the so-called Celt-Iberian inscriptions, along with forms which recall the variations of Asia Minor and Hindostan. Of these, however, I have hardly made a study.[14] Nor are they the last specimens of old Turanian literature in the west. That supposed solitary example of Pictish writing in Scotland, the Newton Stone, an accurate copy of which I owe to the kindness of President Wilson of University College, is an aberrant, but easily recognizable, type of the same wide spread writing.[15] I have not had time nor opportunity to compare the forms presented in the Sinaitic inscriptions, and in the aboriginal alphabets of northern

[13] As accessible to the general reader I refer to the samples of Phrygian and Lycian inscriptions contained in Professor Rawlinson's Herodotus, Appendix Book I, Essay XI., which will be found to bear out my statement. Indeed Professor Rawlinson in treating of the Lycians (12, vi.) note 8, says: "The roots, however, are for the most part curiously unlike those in any other Indo-European language." In the first Lycian inscription there given I read the middle word of the first line which has been rendered *erafazeya*, as *Sidara Parmene aur*, which is Basque for Sidara or Sidari, son of Parmene. Independently adapted from the old hieroglyphic system, which long lingered in Asia Minor, although generally on the model of the Greek alphabets, the cursive Hittite writing, while presenting everywhere many resemblances, also exhibits variations that call for careful study and comparison.

[14] Since this paper was submitted I have received from the Rev. Wentworth Webster, of Bechienia, in the Basses Pyrénées, copies of Celtiberian inscriptions, which, with slight variations of a few characters and with one or two new words, one of which I have since found in the Cippus of Perusia, accord with the Etruscan. Two of them belong to the period of Roman occupation in Spain.

[15] Not only the Newton Stone, but many inscriptions hitherto read as the work and memorials of obscure Norsemen, are Pictish records, and establish beyond question the Iberic character of that early British population.

Africa. Neither have I yet been able to pay the full attention which I should like to give to Dr. Hyde Clarke's extensive researches in the field of ancient Turanian alphabets.[16] The inscribed whorls found by Dr. Schliemann at Hissarlik, to which he has recently been applying himself, are undeniably of the class under consideration.

From the foregoing statement, it will be seen that the chief materials for determining the phonetic values of the old Turanian characters are the Aztec hieroglyphics, the Corean alphabet, the Cypriote syllabary, and the bilingual inscriptions of Asia Minor. The Etruscan bilinguals have, so far, been a barrier in the way of progress.

THE LANGUAGE OF THE ETRUSCAN INSCRIPTIONS.

After transliterating the first twenty lines of one of the Eugubine tables, I found myself among Basque constructions. The forms of the auxiliary verbs *naiz* and *dut*, such as *bagare*, *guinela*, *balu*, *banuen*, are so peculiar and recur with such frequency, that, so far as my knowledge of languages goes, it is impossible to mistake the Basque for any other tongue.[17] The Basque vocabulary is otherwise common to a large family of languages, which I have in many papers dealt with under the name of Khitan. I am not aware that there is any tradition of an Italian origin among the Basques, save that

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[16] Set forth from time to time in communications to the Athenaeum, Nature, &c. See Athenaeum, July 25th, 1885, p. 112, for the Hissarlik whorls.

[17] Bagare, modified indicative present, 1st plural, of the verb *naiz*, I am.

Paradigm.

banaiz, bahaiz, bada—if I am, thou art, he is.
bagare, bazarete, badire—we are, you are, they are.
Guinela, modified indicative past, 1st plural, of naiz.

Paradigm.

naincela, haincela, cela—(it is said) that I was, thou wast, he was.
guinela, cinetela, cirela—we were, you were, they were.

Balu, modified indicative past, 3rd sing., of the verb *dut*, I have.

Paradigm.

banu, bahu, balu—if I had, thou hadst, he had.
baguinu, bacinute, balute—we had, you had, they had.

Banuen, modified indicative past, 1st sing., of *dut*.

Paradigm.

banuen, bahuen, bazuen—(it is asked) if I had, thou hadst, he had.
baguinuen, bacinuten, bazuten—we had, you had, they had.

Lécluse, Manuel de la langue Basque, p. 59, 64. M. Lécluse gives five modified indicatives for each of the two auxiliaries. Of the five modifications of naiz, bagare belongs to the first and guinela to the fourth. Of those of dut, balu belongs to the first and banuen to the third.

noted by M. Francisque-Michel in *Le Pays Basque*, which makes the great chief Uchin the founder of Urbinum in Umbria.[18] Nothing, however, could be more probable than the unity or near relationship of the two southern Turanian peoples, the Etruscans and the Basques. The similarity of the Celt-Iberian and Etruscan alphabets is another point in its favour. The most convincing proof, however, is afforded in the Umbrio-Eugubine tables, where we read, in plain Roman letters, of the *trifor Tarsinater, Tuscer, Naharcer, Japuscer*, that is "the threefold Tyrseni, Tusci, Navarri, and Guipusci.[19]

In my articles on the Khitan languages, published in the Transactions of the Institute, in a paper read at the meeting of the American Association for the Advancement of Science at Minneapolis, and elsewhere, I have set forth the fact, that, various as are the grammatical forms of Basque, Caucasian, Yeniseian, Japanese, Corean, Iroquois, Choctaw, and Atzec, they are one in point of vocabulary, and constitute, with many other members, a linguistic family of no small importance. The parent speech belongs to Syria: West of Syria, in Asia Minor, Italy, Spain, and Britain, the inscriptions yield Basque. East of Syria, in India, Siberia, and on this continent, the Japanese at first, and afterwards the Aztec, are the languages set forth by them.[20] I have already shown how the Hittite name, Cetaei in the Troad, Cetii in Cilicia, Khita in Syria, Cathaei in the Punjab, Khitt in Siberia, Khitan on the borders of China and Corea, and Citin in Mexico, shows the track of the

[18] Francisque-Michel, Le Pays Basque, p. 229.

[19] In this connection I may mention a remarkable book by Curzio Inghirami, who has generally been regarded as the Chatterton or Ireland of Italy. This youth found in an envelope of bitumen and other materials several documents written in Latin and Etruscan characters, setting forth the history and religious rites of the Etruscans, down to the time of Sylla. Pignotti, in his Storia della Toscana, regards the *Fragmenta prope Scornellum reperta* as a forgery, and gives cogent reasons for the opinion, although, on account of his youth, he exonerates Inghirami. The discovery of the documents was made in 1634. I have bestowed some attention upon the Fragmenta, and, judging them solely, of course, by the internal evidence, am not convinced of their spuriousness. One of the most remarkable and, in Inghirami's age, uncalled for statements in the book, is that which gives the Cethic or Hittite name to the aboriginal Etruscans who came with Vandimon and his son Japetus into Italy. To base anything at all upon the statement of a doubtful work would be unscientific in the extreme. I simply refer to it in the hope that Inghirami's treasure-trove may be subjected to a more searching analysis than has yet been made of the work.

[20] I refer more particularly to my articles on the Khitan Languages which appeared in the Transactions of the Institute, Vol. I., Fasciculus No. 4, 1883, p. 282, Vol. II., Fas. 2, 1884, p. 158. The coincidence of the Basque and Japanese vocabularies is set forth in many parts of this paper. The Aztec, as belonging to the same family, is useful in explaining the Mound Builders' written remains. Lat Indian, Siberian and ancient Japanese inscriptions are read in the Japanese.

foremost among northern migrating peoples. To the same race the Etruscans belonged.

The threefold Tyrseni, Tuscer, Naharcer, Japuscer, carry us back to Mesopotamia, the land of the Nairi or Naharina, and to the included region of Khupuscai, as well as forward to Navarre and Guipuzcoa. The former even take us to this continent, where the Aztecs or Citin also called themselves and their tongue Nahuatl or Navatl. Who the Tuscer were, it is harder to say, for the final *er* is a termination; otherwise the great Basque name Euskara would at once suggest itself in such a form as the Dioscurias of Colchis, now Iskurieh, near which Chapsoukes or modern Khupusians and eastern Guipuzcoans dwell. In the East, Hamath is more prominent than the Mesopotamian Hittite names, whether we view it in the Himalayas, the Emodi montes of antiquity, or in Yamato, the mountain door, or native name of Japan.[21] It is possible, therefore, that radical differences in grammatical construction, resulting from independent culture and environment, may have characterized two distinct branches of the Hittite family prior to their great migrations, which began in the seventh century before Christ. Certain it is that the auxiliary forms of the Ibero-Etruscan inscriptions are not those of the Hittites in Asia.

Of the Etruscan words furnished by classical authors, many at once reveal their Basque character. *Lar* or *Lars*, as in Lars Porsenna, is the Basque *larri*, great. *Lucumo* is, as the Cippus of Perusia reveals, *al auka ma*, composed of *al* power, *auka* choice, and *ema* give, denoting an elected potentate. Varro informs us that *atrium*, the fore-door or porch, was an Etruscan word. It is the Basque *athari*, a porch. Hesychius gives *damnus* a horse, which in modern Basque is *zamari; ataison*, a vine, not so easily recognizable in *ardanza; aracos*, a hawk, which is probably *arrano*, the eagle; *falae*, mountains, which is *pilla*, a mound. Festus furnishes *nepos*, luxurious, in which we may detect the Basque *napur*, a glutton; *buris*, the ploughtail, which is either *buru*, the head, or *burdax*, the extremity; *subulo*, a flute-player, which exhibits the same form as

[21] It has been suggested to me that too much is made of what may be a mere accidental similarity of name. It must be remembered, however, that the theory of chances is against the constant repetition of several names in a series; that the names appear in connection with cognate languages, modes of writing, and other confirmatory connections. To build any theory, which I have no desire to do in any case, upon verbal resemblances alone would be as unwise as it would be to overlook them in an inductive process for ascertaining fact.

chambolin, a player on the tambourine. The three words *hister*, *ludio*, an actor or player, and *ludus*, a play, appear to have been forms of *hitz*, speech, and *elhe*, discourse, similar to *elhatari*, a fine talker. There is no present form *hitztari*. *Laena*, a woollen cloak, contains the Basque *ille*, wool.[22] *Lanista*, which according to Isidore meant *carnifex* in Etruscan, is probably derived from *iltzen*, to kill. However, if it mean gladiator or warrior, it may connect with the Etruscan name for Hercules, which has been read *Hercur*, *Hericthse*, but which I read *Lanetu-chipido* and *Lanetu-uchimonone*; the essential word *Lanetu* being the Basque *lanthu*, to work, labour, in allusion doubtless to the labours of Hercules. *Aesar*, a god, should be *Aitor*, the divine hero of the Basques.[23] The name of Jupiter on the Etruscan pateræ, which has been read *Tina* or Tine, should be read *Gouk-*

[22] From *ille* comes ilain, wool merchant. M. Van Eys suggests as its derivation *ille egin*, to make wool, not exactly the work of a wool merchant. But some such form as *ilain* may fitly have signified in ancient times "made of wool." Laena is one of the glosses furnished by Festus.

[23] Other glosses I submit with some hesitation. According to Hesychius, Boreas was *antas* in Etruscan. In Basque *ipar* is the north wind, and *aize* wind in general. There is a Basque verb *hant*, *hantu*, with the French signification entier, but whether entier is to be taken in the signification of blow as well as of puff and swell, I do not know. The Etruscan *arse verse* is made to mean *averte ignem*. The present Basque word for "couvrir le feu" is *izark*, of which the etymology seems unknown. Arse may be an old form of *errauts*, cinders, the first element in which is the verb *erre*, to burn; and *verse*, the original of *barreatu*, *barreatzen*, to disperse, scatter. The latter word is identical in meaning with the Japanese *barasu*. Agaletora, which Hesychius translates "child," I take to be not *puer*, but *infans*. The word does not exist, so far as I know, in modern Basque, but its constituents do. These are the verbal adjective *ichilla*, silent, and *tar*, now rarely used save as "suffixe de l'ethnique," as in Burgostarra, an inhabitant of Burgos. Yet it appears in *anai-tar*, fraternal, from *anai*, brother. Ichillatar would thus be the exact equivalent of the Latin *infans*. The Etruscan months, in the general character of their names, agree with those of the Basques. Velitanus or Velcitanus, March, may correspond with the Basque *epailla*, the initial *e* not being radical; Ampiles, May, is more like Ilbeltz, January; Aclus, June may survive in *baguilla*, the Basque name of that month, but is more like *hacilla*, November, or *ceceilla*, February. Coelius, September, has also a form like *ceceilla*. Isaneus, July, is in Basque *uztailla*; and Ermius, August, is more like *urria*, October. *Druna*, a gloss of Hesychius, is made equivalent to the Greek ἀρχή, which some Etruscologists have translated as the Latin *principium*, others as the English "sovereignty." I am disposed to render the Greek by the equally allowable "origin, source," and to find its equivalent in the Basque *iturri*, source, and *jatorri*, origin. Balteus, a sword-belt, one of Varro's glosses, is probably a compound of *ubal*, a strap or belt, *abal*, *habela*, a sling. M. Van Eys says: "Est-ce que *ubal* et *abal* ne seraient pas des variantes du même mot dont la signification primitive était courroie?" Initial vowels in Basque are not necessarily radical. See my paper on the Khitan Languages, Proceedings Canad. Inst., 1884, Vol. II., Fas. 2, p. 163, rule 2, a. Falandum (falando, *Deecke*), *coelum* cannot be the sky, which is *zeru* in Basque, but may denote the celestial powers or gods, and be a form of *Alindun*, he who has power or dominion. Alin instead of *al* appears in the Eugubine tables and on the cippus of Perusia as the word for dominion. Aldun, *puissant*, literally "who has power," is the modern Basque form. The initial *f* is thus, of course, unaccounted for. It is worthy of note that b, g, d and o, letters denied to the Etruscan alphabet, appear in these glosses.

ara, and *Goukane* or *Goukain*. The latter is an inversion of the Basque *Jaincoa*, the word for god.[24] The name of Juno, generally read as Thalna, is really *Morasa-kara;* the former part of the word being the same as the Latin *Murcia*, wrongly identified with Venus. But Cupid is a purely Etruscan word, for the form read Turia is really *Cupido aurra*, or the child Cupid. Maris Turan, so far from being the son of Venus, is really *miratu uno Cupido raka*, probably meaning look towards Cupid.[25] Venus is also an Etruscan word, which has been read Pelias, as her son's name has been read Castur.[26] The first is *Banesa aurra no*, of the son of Venus, and the second *uchirano Cupido*, the precise meaning of the first part of which is hard to determine, as *uchi* may be *utz*, *hitz*, and many other Basque words. The name read Menle, Menerva, Menrva, does indeed denote the goddess Minerva, but her Etruscan name was Mineka; for these words give *Mineka-sane*, *Mineka-netugira*, *Mineka-tugira*. The root *men*, power, is doubtless the chief element in the name. The Etruscan title of Vulcan has been read Sethlans. It should be *nonemosarakano* or *non ema su rakano*. The first three words mean *who gives fire*. I am in doubt as to the precise meaning of *rakano*. The accidental coincidences Hercur, Castur, Pelias, Menerva, have done much to confirm Etruscan students in the application of Roman values to the letters of Etruria, and, with the ingenious parallel drawn by M. Bréal between the Umbrian and Etruscan tables of the Eugubine inscriptions, threatened, for a time, to put an end to my own researches.

THE PHONETIC VALUES OF THE ETRUSCAN CHARACTERS.

The Etruscan syllabary,[27] as represented by the sepulchral inscriptions in Lanzi, is very poor, and it is still more so in the Eugubine

[24] Jaincoa, jinko, jangoiko, is supposed to be derived from *jaun*, lord, master, and *goi-ko*, of the height. The Etruscan shows rather that the original was *goi jaun*, the high lord.

[25] This and the accompanying Etruscan names of divinities are taken from the so-called paterae, really bronze mirrors, found in Etruscan tombs. See Lanzi, Vol. II., table VI., *seq.*, and the Rev. Isaac Taylor's Etruscan Researches. The latter writer states that *maris* denotes boy, a child of the gods. Thus *maris Turan* means "the boy of Venus," and *maris Thalna*, "the boy of Juno." Now the words read *maris Turan*, I read *miratu uno Kupido raka*, which may be "this one looks towards Cupid."

[26] See Lanzi, Vol. II., Table VII., Plate 5, where in connection with the figures represented appear the words TVDIA and ΛELIAS. The first has been read Turia, the second Pelias. But the first is *Kupido aur*, and the second *Banesa aur no*. Also Plate 6 of the same Table has KASTVD, generally read Castur. It is *hitzrano Kupido*.

[27] See page 163.

Tables. It possesses no sign whatever to mark independently the short vowels. Indeed, it is doubtful if it has any vowel sign at all, for the simple perpendicular line, or Roman I, rather seems to represent an aspirate, and may give ha, he, hi, ho, hu. It is the Aztec *hui* or *ui*, a thorn. This vowel sign or aspirate syllable sometimes presents difficulty, by appearing with its duplicate II, for these two perpendicular lines or parallels denote the short sound of *t* or *d* in composition, te, ti, de, di, et, ed. In Aztec it is represented by *titlan* or *tlantli*, the teeth. In the Hittite inscriptions it is generally perpendicular, but, on the bilingual of Tarkutimme, it is horizontal. The aspirate syllable appears in composition with a character identical in its simple form with the Roman C, when the compound assumes the shape of K. The C is a weak sibilant, *chi*, *che*, *zi*, *ze*, *is*. The combination K gives *hitz*, *ots*, *uchi*. C is the Aztec *chichi*, which Brasseur de Bourbourg renders *poumons*, *mamelles*. It occurs frequently in the Hittite inscriptions, alone and in composition. The only other case of combination is in the form B, in which the aspirate or broad vowel is joined to the character resembling the figure 8.[28] This figure 8 is the Etruscan l in all its powers, la, le, li, lo, lu, al, el, il. With the prefixed I, in the form B, it seems to denote ol, ul. The Aztec has no hieroglyphic for l, but that for *tlalli*, a piece of ground, the Basque *lurra*, is identical in form with the older square form of 8, which is common in Etruscan inscriptions, and has generally been read as h. The Corean l is square or angular; that of Cyprus is identical with the Etruscan. The Etruscan has only one character for all the powers of *r*, which is hardly ever initial in Basque words. It is almost identical with the Roman A, but with rounded top, and has been thus read. In the Hittite monuments it presents a rounded form, at once giving the bow as its original. The Aztec has no r, but, as I have shown in my article on the Aztec and its relations, the peculiar Mexican combination *tl* may represent an original r or l. The Aztec symbol coinciding is *tlaoitolli*, the bow, the Koriak *ratla*.[29] In the Lycian

[28] In the Cippus of Perusia this form, which is common in the Eugubine Tables, is replaced by the horizontally intersected parallelogram, read by Etruscologists as *h*. Generally the latter character and 8 appear to denote the same sounds and to belong to different stages of the written language. But the Cippus shows beyond doubt that the angular form was reserved for *l* preceded by a long vowel. In B, the combination IS appears, the perpendicular line representing the long vowel.

[29] I compare the Aztec with the Koriak of eastern Siberia as the resemblance between the Koriaks, Tchuktchis and Kamtchadales on the one hand and the American Indians on the other

inscriptions this character wants one of its extremities, and assumes the form of the figure 4. The Etruscan has two forms for the powers of M. The long sounds, ma, mo, mu, are represented by a circle or O, which frequently has an intersecting line, or by a diamond or square. Etruscan scholars have taken this to represent the Greek theta. It is, as I have already indicated, the Aztec *matlactli*, denoting ten, but represented by a figured circle or square, which may have meant a shield originally. This is a very common Hittite emblem, and occurs in the many groups which I have read *mati*, king.[30] The feebler sound of M, mi, me, im, em, is represented by a character not unlike the Italic *m*, which has correctly been read as such.[31] This I have not found in Aztec. As a hieroglyphic it must have denoted a ridge of mountains, and the Basque *mendi*, a mountain, was probably its original. It is common in Hittite, and the Cypriote mi is in accordance with it. The Etruscan character which coincides in shape with the Roman M, has not the sound of that letter. Indeed, this has been discovered by Etruscan students from a comparison of texts, so that they have made it the same as S, with the power of the Roman s. But this character, set forth variously as M, S, Z, and a division sign set perpendicular, has the values, na, no, nu. In Aztec it has lost its broad sound, being the *ne* of *neitl*, an arm. As an arm, these sounds are frequently represented on the Hittite monuments. The Corean *n* has also a form more resembling the arm, which the Etruscan was compelled to modify, lest it should be mistaken for *sa*, etc. The Cypriote *ne* is identical with the Etruscan character which I have compared to a perpendicular division sign. It was probably of phallic origin. Though common in Hittite, it is of rare occurrence in Etruscan. To denote the weaker powers of N, ne, ni, en, in, the Etruscans employed a symbol identical in form with the Roman E. For this I have no Aztec equivalent, and, although it appears in Asia Minor, India, and elsewhere,

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has often been pointed out, and as the vocabularies of these Siberian tribes coincide with the Aztec. See a few examples in my paper on the Aztec and its connections, already referred to.

[30] In the Hittite inscriptions. See a brief essay entitled "A translation of the principal Hittite inscriptions yet published." For the inscriptions themselves see Transac. Soc'y Bib. Archaeol., Vol. VII., Part III., p. 429 seq. The word *mati* king frequently occurs in the inscriptions, and is represented by a shield-like oval on its side, bisected perpendicularly by three lines, followed by a representation of a basket.

[31] This character does not belong to the Chalcidian Greek alphabet, nor does it occur in any Latin or other Italic inscriptions, save the Umbrian, Oscan and Faliscan, which are almost identical with the Etruscan.

its phonetic value is a matter of inference, so far as I remember. The majority of values being given, it is of course not difficult to infer the value of the unknown.[31a]

Passing from the liquid to the dental combinations, the Etruscan presents us with three forms for ta, to, tu, da, do, du, resembling the Roman D and P, and the Italic b. In the sepulchral inscriptions these seem to be interchangeable, but, in the Eugubine tables, I imagine that I have detected differences, the D generally standing for *tu*, and the b for *da*. This variable sign was, I think, originally an animal head, in Aztec *tochtli*, the rabbit, but in Hittite a gazelle. It is thus the first character in the Hittite legend of Tarkutimme. The weak powers of T and D I have already indicated. The labials are two, or, at most, three in number. B, P, V, with a, o, and u, are represented by a perpendicular line, from the top of which falls, at an angle of 30° or more, a line, generally of half the length, but sometimes continued farther. It may be represented by the figure 1 with a down stroke. This is the Aztec *pil, chose suspendue*, according to Brasseur. It is read as *p* by Etruscan students. The same consonants, with e and i, are represented by a form identical with the Roman V. This, by a strange inversion, is a vase or cup, the Aztec *palli*, which Brasseur holds to mean *couleur noire*.[32] As I have shown in my article on the Aztec and its Relations, *palli*, like the Japanese *biru*, also means "that which holds or contains." The Cypriote *pa*, like that of the Siberian inscriptions, is represented by two *v*'s, one above the other. The Corean *p* is a square *v*. There is, perhaps, an F in Etruscan, having the same form as the Roman, but it is hard to separate it from the form for *gi*, which, with other gutturals, demands attention.

The sounds ag, eg, ig, ge, gi, are expressed by a character resembling the Hebrew *beth*, or a Roman E, without the tongue or central short horizontal line. As the basal line of this character

31a I have since found the original of this character in Hittite and in Cypriote. See plate.

32 Brasseur de Bourbourg, Histoire des Nations Civilisées du Mexique, &c., Tome 1, Introduction, p. LIV. My friendly critic complains of obscurity in the text. The *inversion* is that which gives in Aztec the sound *pa* to the equivalent of V and the sound *pi* to the equivalent of ⅄. As I read these Etruscan characters, V is *be, bi, pe, pi* and ⅄ *ba, bo, bu, pa, po, pu*. While the preponderance of evidence furnished by Hittite, Lat Indian, Siberian and Etrurian inscriptions is, I think, in favour of the renderings I have given, there is much that tells in the direction of the Aztec equivalents. I leave it therefore an open question whether V should be *ba*, &c., and ⅄, *be*, &c. But this must not be decided hastily, for we cannot tell what changes vowel sonnds have undergone in a group of languages yet unclassified, and for which no laws have been formulated, save the few set forth by me in the Khitan essays.

is frequently drawn across the perpendicular, it is sometimes hard to distinguish it from F. Where more squarely cut, there is the same danger of confounding it with C, as prevails in the case of C and G in Roman inscriptions. I am in doubt as to the corresponding Aztec hieroglyphic, but think it is either *camatl*, the mouth, or *quauhtli*, the eagle.[32a] The latter supposition may be justified from the Hittite, in which the eagle represents the *ke* or *ge* of Karkemish. In Corean, *kh* agrees, being in the shape of the Roman F. It has conveniently been read in Etruscan as *v* or *z*, according to the exigencies of the interpreter. The sounds *ka* and *ga* are represented in Etruscan by a character, generally read *n*, varying in appearance in different texts as the Roman N and H, and the Hebrew *cheth*.[33] Its original is the Aztec *calli*, a house, with the shape of which the Hittite hieroglyphic corresponds closely. In the cursive Hittite, or that in which the hieroglyphic begins to fade away, it appears in form something like the Italic *h*, or a child's rude drawing of a chair. It is wanting in Corean, and, so far as I know, in Cypriote, unless the twisted *ko* of the latter syllabary be its equivalent; but it is common in Asia Minor,[34] in the form of an old Greek or Phœnician *n*. In the Lat, Siberian, and Mound Builder inscriptions, the same character assumes the Etruscan and cursive Hittite forms. The most frequently recurring guttural sign is one which generally appears as a Roman Y, one of the forks of which is carried across the perpendicular. At other times, it has the perfect form of Y, and, at others again, it becomes a cross or a T. A comparison of texts at once demonstrates that these are variants of one sign, and, on this account, Etruscan students have uniformly read it as *t*. It really denotes ko, go, ku, gu. Its Aztec representative is *quahuitl*, a tree. Its tree form is recognizable in the Hittite inscriptions, and, in its Y equivalent, it constitutes the radical element in the Cypriote *ku*.[35]

[32a] It may seem improbable at first sight that F should in any way represent an eagle, but a comparison of the original form of the character with that of the Hebrew *gimel*, derived from a camel, will show analogous changes.

[33] The angular *N*, like the *M* referred to in note 31 above, occurs in no Latin or Greek alphabet.

[34] Lycian and Phrygian.

[35] The lack of appropriate type compels me to make references which to the general reader must be more or less obscure. The Cypriote sign for *ku* is a Saint Andrew's cross, through the intersecting lines of which a Y is drawn perpendicularly. The cross with other lines, horizontal or perpendicular, is the Cypriote vowel symbol *a*, *e*, *i*. The Y is thus the radical element in the form for *ku*.

Still another guttural sign, which at times replaces equally *ka* and *ko*, or the house and the tree, is one which resembles an arrow pointing downwards, or an anchor with the flukes pointing upwards. This, doubtless, is but another form of the tree, or of a plant, the so-called flukes representing the branches or lower leaves. This does not agree with the Cypriote, for in that syllabary the phonetic value assigned to the same character is *te*. It is, however, one of the tree or plant forms in Hittite, and occurs abundantly in India and Siberia. In the famous edict of Asoka, it constitutes the last character in that monarch's name.[36]

The sibilants only remain. Two of these, in the forms C and K, I have already set forth when dealing with the aspirate I. The broad powers of S, *i.e.*, sa, za, as, so, su, are represented by a single character, generally read *l* from its resemblance to that Roman letter. However, the lower limb of the Etruscan character is not horizontal, but stands in the same relation to the perpendicular that the upper limb does to that of the character *ba*, *pa*. I can think of no sign exactly corresponding to it, although the radical sign in arithmetic comes near it. In the Indian inscriptions, the same values are represented by the perpendicular sign in geometry. Its Aztec equivalent is *xotl* a foot. In Hittite it has the shape of a foot or a carpenter's square. In Corean, the lower limb leaves the perpendicular above the base and slants downward, still preserving the idea of a foot. The upward slope of the Etruscan may be a reminiscence of the up-turned toe of the characteristic Hittite boot. The last character calling for mention is one which combines the one just considered with the Y-like *ko*. It consists of a perpendicular, touched or traversed by two equidistant lines at an angle of 30° or more, according to the fancy of the artist. It may roughly be represented by a double dagger, and appears to have the phonetic value *itch*, *ich*, *itz*. It may, therefore, be the Aztec *itztli*, a dart. In Hittite, a single dagger probably represents the same. The Cypriote *si* shows some resemblance to this character, but its value

[36] Asoka, King of Cashmere, is spoken of in the Raja Tarangini or History of the Kings of Cashmere, book I. sl. 101 seq., as the first royal convert to the faith of Buddha. See Troyer, Radja Tarangini, Tome II in loc. cit. also p. 406 seq.; and for reference to the inscriptions p. 413. Facsimiles of some of the inscriptions are found in the Journal of the Royal Asiatic Society. The name of the author of the inscriptions has been read as Piyadasi, whom Indian scholars have identified with Asoka. I read the author's name, which occurs frequently, but not in the characters read Piyadasi, as Asoka. But I find no mention of Antiochus, Ptolemy, and Magas, whose names are said to appear in these proclamations.

is attested by the Corean signs for *ts*, *dz*, which are combinations of *k* and *s*. Such then is the meagre Etruscan syllabary, and such its derivation. I might, perhaps, have gained more attention and credit for its decipherment, had I, as might easily be done, left the distant Aztec out of sight. This, however, would have been to sacrifice, to a dogmatic dictum of "antecedent improbability," common gratitude, love of truth, and really scientific principle. Everything is antecedently improbable in the region of the unsolved, otherwise the unsolved would not exist.

To the names of those already mentioned who have materially aided me in the work of decipherment, I should add my acknowledgments to W. Harry Rylands, Esq., Secretary of the Society of Biblical Archæology; M. Léon de Rosny, President of the Institution Ethnographique of Paris; W. H. Vander Smissen, Esq., Librarian of the University of Toronto; Hyde Clarke, Esq., Vice-President of the Anthropological Institute; the Rev. George Coull, A.M.; my colleague, the Rev. Professor Coussirat; and last, but not least, to J. C. Robertson, Esq., B.A., Classical Fellow in University College, Toronto, for his kind care in revising the proof-sheets of this paper.

THE ETRUSCAN SEPULCHRAL INSCRIPTIONS.

The Rev. Isaac Taylor and other Etruscologists, while failing to translate these inscriptions, have made some good guesses. Such are their suppositions that the characters they have read ISA denote a wife, those read SEC, a daughter, and those read AL, a child. If, according to their own method, they had read SA, EC, and NAL, they would have been more correct. The first is *nare* or *anre*, wife; the second *nechi*, now *nesca*, daughter; and the third *karasa*, or in modern Basque, *sortze*, natus.[37] Other terms of relationship are *uta* and *babe* father, and *uga* or *uga anre* mother or lady mother, some-

[37] It has been objected that *karasa* and *sortze* are difficult to reconcile. That NAL, *karasa* means "natus," several bilinguals attest. The Basque "natus" is *sortze*. The only difficulty in the word is the replacement of *ka* by *so* after an interval of over a thousand years in the history of the language. See Van Eys, Dictionnaire Basque-Francais, Introduction, p. XLIII. Tableau des permutations des consonnes dans les mots basques de différents dialectes. K = S, Z, Ch. Karamitcha = zaramika; kirten = zirtoin; kiskaldu = chichkaldu; gale = zale; gapar = zapar; itogin = itozin. For change of vowel see in the same dictionary, khurruka, khurulla derived from karraka; garratz = kirats, kharax; galde = galdo; marruskatu = murruskatu; salhutzea = zaulitzea; chokon = zokon; elkar = elkor; etzin = etzan; ala, halatan = hola, holatan. The Japanese equivalent of the Basque *sortze* is *haramu*. One class of Japanese verbs derived from nouns is formed by adding *mu* to the noun; thus from *hara*, belly comes *hara-mu* to be with child. In the same way but with a different verb-former *tu*, *tzen*,

times also rendered by *amona* and *amona-anre*. *Uta* is the present Basque *aita*. *Babe* only survives in the language of children. *Uga*, though common in composition in modern Basque, has ceased to designate a mother, but *amona* and *amandria* remain. For child, the common word is *ura*, the modern *aurra ;* for a little child, some compound of *chipi*, which still means little. Daughter is more often *albi* or *albisa* than *nechi*. These forms are now *alaba* and *alapichi*. The commonest words for brother and sister are *noba*, now *nebia*, and *arreba* or *arba*, which is unchanged. The word *bau* or *bahi*, which means a pledge, seems to denote husband or wife. Child is sometimes rendered *ume* or *hume*, the unaltered form. As read formerly, *uta* would be IR ; *babe*, PU ; *uga*, IN ; *uganre*, INSA ; *amona*, THE ; *amona anre*, THESA ; *ura*, IA ; *chipi*, CU ; *albi*, *albisa*, HU, HUL ; *noba*, SP ; *arreba*, AP ; *bahi*, PI ; and *hume*, IM. They were brave men, if not over-wise, who led a forlorn hope against such a formidable array of darkness.

Etruscan inscriptions are, with few exceptions, written from right to left. For convenience sake I invert the text where it is introduced, and the direction of the individual characters. For lack of Etruscan type, I am compelled to represent these characters by the nearest equivalents which an ordinary English font supplies. A reference to the descriptions under the heading "The Phonetic Values of the Etruscan Characters," will enable the student to identify these equivalents with the original forms in Lanzi's Saggio. The following, in the order of the English alphabet, are the Etruscan symbols with their varying phonetic powers. Aberrant forms are grouped with the English letters they most resemble.

A = ra, re, ri, ro, ru ; ar, er, ir. Examples : AS rano, YA gure, LA zari, AO roma, AD artu. When *r* is preceded by a long vowel, *o* or *u* (*or*, *ur*), it is generally rendered by I A.

B = ol, ul, hal, hel, hil, hol, hul. The same character is the horizontally bisected parallelogram, now read as *h*. It is a compound of I and the following character. Example : BE alne ahalne, BD olatu.

8 = la, le, li, lo, lu, al, el, il. Examples : 8ED lanetu, 8IS leheno, 8V albe.

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the Basque *zorro*, ventre, becomes *sortu*, *sortzen*. The Japanese *shiroi*, white in the same way forms *shiromu*, to become white. The corresponding Basque *zuri*, *churi*, white, by adding *tu*, *tzen* forms *churitu*, *churitzen*, become white, whitens. Such instances might be multiplied indefinitely.

C = chi, che, si, se, zi, ze. Examples: CV chipi, CAE ziren, CA zeru.

D, P, b = to, tu, do, du; but in many cases in the Eugubine tables these three characters represent every power of *d* and *t*. Much as I would like to attach definite values to each of them, my knowledge of the relation in which ancient Basque or Etruscan stands to modern Basque phonetically, is not such at present as to justify me in so doing. See also II.

E = ne, ni, en, in. Examples: YE gune, ED entu.

F = ag, eg, ig, gi, ge, but never ga. FE agin, egin, VF begi, FA igar. It is possible that begi was originally be-ig.

H, N = ka, ga generally, but was probably used also for ak, ke, ki, ge, gi. Examples: HV gabe, NA kari, now ekarri; also NED now kendu.

I = ha, he, hi, ho, hu, au, ai, ou, eu, oi, ō, ū, hau. Examples: IA hiri, aura, ōra. The poverty of the Etruscan syllabary multiplies the equivocal to such an extent that the context or even a knowledge of the nature of the document in which such words occur must decide their value.

II = ta, te, ti, da, de, di, at, et, it, ad, ed, id. See above D, P, b. This sign is never used for to, tu, do, du. As for ot and ut, od and ud, they are represented by IP, Ib. Examples of II are OII emat, IIV debe.

K = os, ots, oz, otz, us, uts, uz, utz, hatz, hitz, hez, hots, huts. It is a compound of I and C. In the inscriptions of Asia read by Japanese it gives ochi, uchi. As representing two syllables, instead of the forms indicated, it frequently, indeed generally, should be read osi, utsi, oze, but never osa, otso, utsu. Examples: K hitz, KV ospe, VKE behatzen, KDE utziten.

L = sa, so, su, za, zo, zu, as, az, sometimes es, ez, but not os, us. It may also denote cho, chu, cha, and ja, jo, ju, when these sounds pertain to the sibilant series. Examples: LA zari, sari, L su, so, LV azpi.

m = me, mi, em, im. Examples: *m*A mira, *m*E imini. See O.

M. See S.

O = ma, mo, mu, am, om, um. Sometimes it represents what is now in Basque *em* followed by a broad vowel, *eman*, which may originally have been OE mane. There are variant forms

of this character, with perpendicular and horizontal intersecting lines, and with crosses contained within them, in some Etruscan, and in the Celtiberian inscriptions. In Celtiberian, O with a dot in the centre represents the Etruscan *m*. I have not determined with exactness enough for dogmatism the different vowel values and positions indicated by the other forms. Examples: AO roma, OA umra, (Umbra) OV ambe, VO pimo.

R. I do not recognize this as a character *per se*. It is a variant of P.

S. Z. M. = na, no, nu, an, on, un. The two last, *on* and *un*, when initial at least, are generally represented by IE, IS, one, uno. But the character M seems specially to indicate these sounds, when the initial vowel or aspirate character is dispensed with. However, M is very often interchangeable with S. The Z is simply a variant of S, and, as far as I can judge, marks a different class of writings, differing chronologically or geographically. Examples: AS rano, ES nion, SI anai, MPAN ondoreak.

T. See Y.

V = be, bi, pe, pi, eb, ib, ep, ip. Examples: VF begi, LV azpi, V8 ibil, YV kube, now jabe.

Y. T. = ko, ku, go, gu. I do not think that originally it represented any other sounds than these. There can be no doubt that YV kupi, kube, kobe, is the same word as the modern Basque *jabe*, *jaube*, lord, but it is better to regard *jabe* as a corruption of *kobe*, than to enlarge the powers of Y. When j and ch represent original gutturals, the words in which these letters occur may be looked for under Y, N, ⊥ and F. When they represent original sibilants, they should be found under C, L and ‡.

⊥ = go. This character, as I have indicated, is nowhere to be found in the Eugubine Tables. It was thus not an essential part of the Etruscan syllabary. I have also shewn that its hieroglyphic origin is the same as that of Y. In the majority of instances in which I have met with it in the inscriptions, it has simply replaced Y, with the value go. But in other exceptional instances it has appeared with Y in the form ⊥Y, and there have been instances in which from analogy

NY, kako, kago, gago, the present gogo, mind, desire, would be expected. This inconsistency I can for the present only state, not explain.

‡ = ech, etch, ich, itch, certainly, and probably ets, its, etz, itz. Examples: ‡VCI ichpichio, ‡I etsai.

·|· same as S. This form, rare in Etruscan, but common in Hittite and Cypriote, occurs in Lanzi No. 419, vol. II., p. 376, for SA anra, now andre.

/ı ⋀ = ba, bo, bu, pa, po, pu, ab, ap. Ob and up are rendered by I/ı. The second character appears in the Eugubine Tables. Examples: /ıED banetu, /ıV babe, /ıAYDE borokutune, now borrokatzen.[38]

There are other Etruscan characters than those I have indicated the powers of, but their signification is not essential to a knowledge of the inscriptions in general, nor is it wise at this early stage of Etruscan study to obtrude that which is less important. I do not

[38] Mr. VanderSmissen calls my attention to an Etruscan syllabary and alphabet upon a *lecythus*, found at Caere, represented in the collection of Fabretti. The syllabary I cannot reproduce in full without an engraving which at this stage is unnecessary. The following sample sufficiently indicates its character:—

	Read by Lepsius:			
ſ ı ſ A ſ Y ſ E	bi	ba	bu	be
/ı ı /ı A /ı Y /ı E	gi	ga	gu	ge
I ı I A I Y I E	zi	za	zu	ze
8 ı 8 A 8 Y 8 E	hi	ha	hu	he
O ı O A O Y O E	di	da	du	de
mımAmYmE	mi	ma	mu	me
M ı M A M Y M E	ni	na	nu	ne
P ı P A P Y P E	pi	pa	pu	pe
* * * *	*	*	*	*
T ı T A T Y T E	ti	ta	tu	te

First I call attention to the fact that the illustrious Lepsius has given values to the characters /ı, O, M, P, which are at variance with those given by the present school of Etruscologists. They make /ı = p, O = th, M = s, and P = r. I think, however, that he is right in reading Y as V.

The alphabet, as nearly as type will represent it, is as follows:

ABCDEFISOIKL(m)M□OPNPΣTYTOL

The 8 is square; the first O is traversed by a horizontal line; the □ contains a cross; the second O has a central dot; the N has a shortened left limb as in old Greek; the second T carries the perpendicular line above the diagonal line; and the L is more like the Greek Ψ.

If the alphabet is Etruscan, D is r according to present readings, and so are the two P's; also the variant T's are read with the same powers, as are the two s forms M and Σ. It is also to be noted that the supposed alphabet and syllabary are not accordant.

Some light may be shed upon this succession of characters by comparing it with another supposed alphabet figured in Dennis's Cities of Etruria, and readily accessible in Browne's History of Roman Classical Literature. The author says: "One example of the Etruscan

profess to exhaust the syllabary or any department of Etruscan philology, but to communicate what I know to those who with more abundant leisure and facilities may be able to reduce to scientific exactness of proportion the stones of a new edifice, which with

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alphabet is extant. It was discovered in a tomb at Bomarzo by Mr. Dennis, inscribed round the foot of a cup, and probably had been a present for a child. The letters ran from left to right, and are as follows":—

8⅃OVYΣDM ∧NmLIOB3FECA

Reversing this we obtain:

ACEF3BOILmN /ΛMDΣYVO⅃ 8

Here, also, B represents square 8; the N is similar to that of the preceding alphabet; the T carries the perpendicular beyond the horizontal or diagonal; the ⅃ is like the Greek Ψ; and the F is inverted. There is also a new character something like the figure 3.

The correspondences are:

Caere. ABCDEFI8OIKL(m)M□OPNPΣTVTO⅃

Bomarzo. A-C-EF3BOI-L m DΣYV

N /ΛM O⅃ 8

I confess that ABCDEF in succession might easily carry conviction to the mind even of the critical student that the powers of the Etruscan alphabet were those of the Latin. I therefore ask the reader to return to this note after having studied the inscriptions in the text. Mr. VanderSmissen suggests the likelihood of the Etruscans in the later period of their history adopting the Greek and Roman alphabets and a complete vowel system. Of this, however, I have no evidence. I incline rather to the belief that they did not adopt the Roman alphabet until they adopted the Latin language. The monuments plainly indicate that the Etruscan scribes assimilated the forms of their characters to those of the Roman letters, but without in the least affecting their phonetic values. As for the order of writing it is just possible that inscriptions reading from right to left may have been modelled on the Roman. But the various inscriptions which I have classed with the Etruscan, namely, Celtiberian, Pictish, Phrygian, Hittite, Indian, Siberian, &c., exhibit little consistency of order, reading generally indeed from right to left, but often from left to right and boustrophedon.

To return to the supposed alphabets, I read that of Bomarzo thus:

A C E F 3 B OI L m N /ΛM D Σ Y V O ⅃ 8

er ze in ag ti la mai su mi ka bano ta ne ku be ma go la

Basque: erre zein gatillu mai su imi ka bana tanka bu makilla

burn who vase tablet fire placing by within strike let the stick

Let the stick strike him who burns the tablet (inscription) of the vase by putting fire into it.

Here it will be observed that I read 3 as if it were ||. This I do on the authority chiefly of the Siberian inscriptions, which use ||, } }, } and 3 for ti, te, &c. The corresponding Caere character is I. The only word which is not modern Basque is *bana*, and this I take to be a form of *barrena*, within. M. Van Eys derives *tanka*, *tankatu* from the Provencal *tancar*. It cannot, however, be other than the Japanese *tataku*, the Choctaw *timik-lih*, the Iroquois *tekkentoks*, and the Aztec *tzotzona*, all meaning to beat, strike, thump, knock. Although *mai* now means a table, it must originally have designated a space upon any object on which subjects might be portrayed or characters written. The Japanese *hi-mei* denotes an inscription on a monument.

The Caere alphabet is:

ABCDEFI8OIKLmM□OPNPΣTVTO⅃

ir aul zi dune ge te la mai utz su mi no ma mi ta ka ta ne ku be ku mago

clumsy tools borrowed from many distant lands I have rough-hewn out of the Etruscan quarries. The syllabary presented is far from an ideal one, but it is certainly as perfect as that of the ancient Phœnicians, who ignored vowels altogether, and hardly inferior to the Hebrew syllabary, prior to the invention of the vowel points within the Christian era.[39]

Basque: iraulzi duen gatillu mai * su imi * * * * * tanka bu * * *
overturn who does vase tablet * * fire place * * * * * strike let * * *

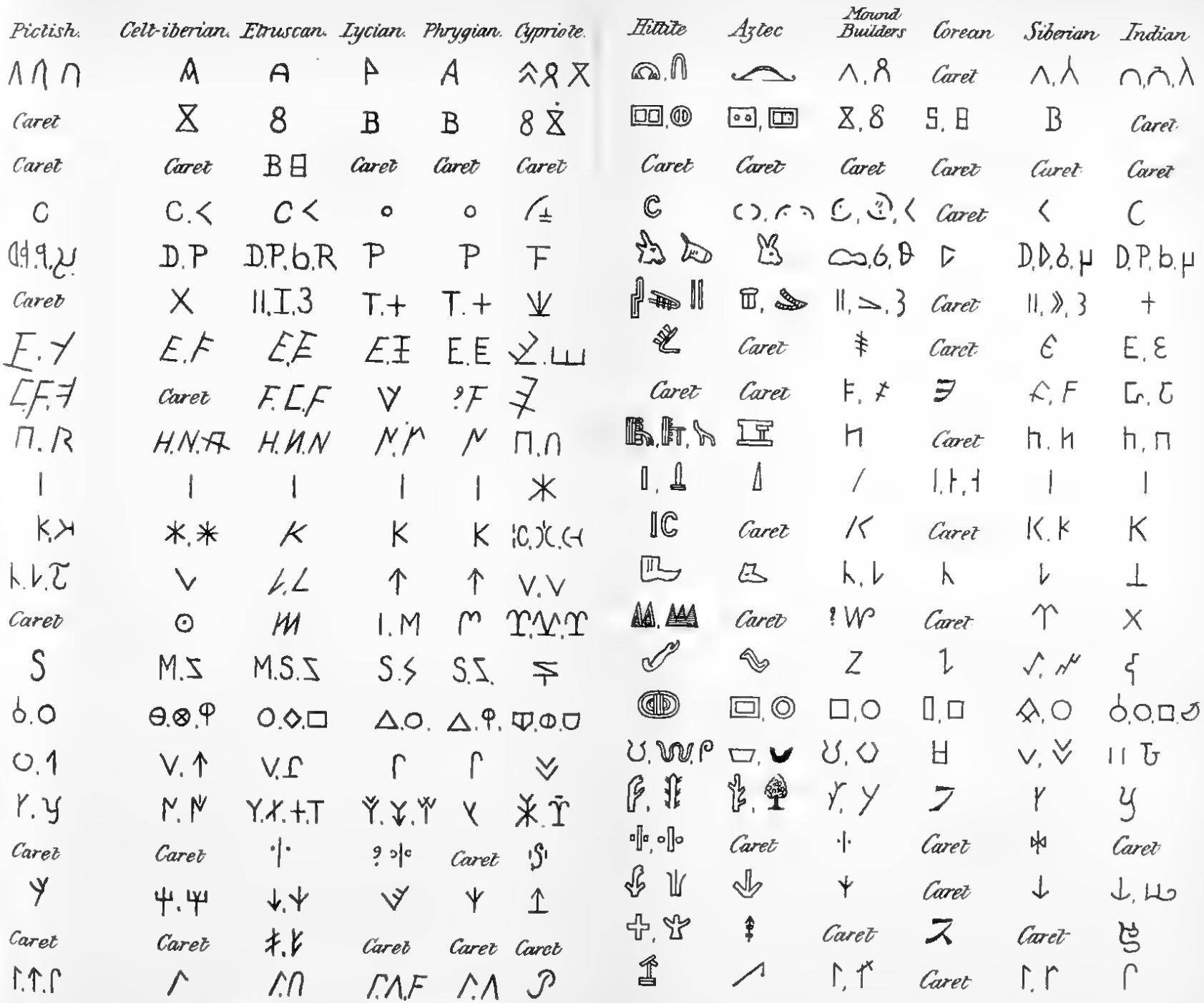
I have not hazarded a complete translation of this corresponding inscription. The K *utz* may be an Etruscan form of *or*, which is now *edo*. The final *kumago* shows the same root as *magola*, which Van Eys (subst. *makilla*) supposes to be *maka*, *makatu*, strike. Such a Malay-Polynesian form as *ku-mago* is hardly in accordance with Basque structure. Nor can I suggest at present an explanation of *no mamita ka*. The Basque has a verb *mamitu*, to curdle, and another, *mamutu*, to disguise one's self in hideous fashion, derived from *mamu*, a spectre or hobgoblin to frighten children with. The Japanese *momonjii* has the same meaning as *mamu*. Can these words connect with the oriental Mamitu, goddess of fate, in the Izdubar legends (G. Smith: The Chaldæan Account of Genesis)?

The supposed syllabary I do not regard as such, but as an ingenious combination of characters on a consistent plan, setting forth words of two syllables, which are not only individually significant, but which may also have formed complete sentences in combination. The Basque roots are largely dissyllabic, so that the parent Etruscan may have been a biliteral language. The first character in the supposed syllabary is not *b*, but the replacer of V, be, bi, pe, pi. It occurs in this hooked form in the Hittite inscriptions and in Asia Minor. In ſ I ſ A ſ V ſ E we may find *behi* cow; *bera*, *bere*, *bero*, the first signifying equally tender and below, the second, his, her, its, and the third, hot, heat; *bebe*, probably an old form of one of the auxiliaries; and *bein*, once.

/I /A /V /E bai, bahi; barru, buru, baru, borra; babe, pabe; bane. Bai has the double meaning "yes" and "spot," *bahi* is a pledge. Barru means "within," *buru*, head, *baru*, fasting, and *borra*, mallet; *babe* is the Etruscan for "father," and *pabe* is Basque help, support; *bane* is Etruscan join, unite. TITATVTE koi gare jabe gune in modern Basque, but in Etruscan gui gure gube gune. This reads correctly "we are desiring the place of the master." Similarly we might read 8I8A8V8E as lohi lara labe lane, and make Basque of it as *lohilla ra labe lan*, towards January the oven works. I do not profess to have read any of these lines, but that they can be read consistently I have little doubt. Corresponding rhyming fragments, but not so perfect in their structure as the one under consideration, are to be found in the nursery lore of all civilized peoples. The reason why final *i*, *ra*, *be* and *ne* were chosen for the composition of the piece is that being postpositions they would fit into the mosaic more perfectly than other syllables. Final *i* is hardly a postposition, but a sign of the dative case.

[39] The poverty of the Etruscan syllabary is by no means without parallel. When the Semitic peoples replaced a cumbrous hieroglyphic system by what are now known as alphabets, they really adopted syllabaries as bare as that of the Etruscans. The Hebrews had only one purely vowel character, namely *aleph*, and although they had expedients for representing long vowel sounds they were very frequently omitted. Thus, as Gesenius states, one form might be read *qatal*, *qatel*, *qatol*, *q'tol*, *qotel*, *qittel*, *qattel*, *quttal*. According to the same authority: "the Phœnicians did not even indicate the long vowels, except in very rare cases; their oldest monuments can hardly be said to have any designation of vowels." The Mongolian and Buriatic syllabaries present similar deficiencies, the same sign representing different sounds, and words quite distinct in meaning and pronunciation being written with the same characters: see Encyc. Brit., Article Mongols. The Javanese, Batak, Tagala, and other syllabaries of the Malay Archipelago are equally defective: see Crawford's Indian Archipelago, Vol. II., pp. 70-71. The alphabet of the Tuaricks of Africa is really a syllabary having no characters whatever to

COMPARATIVE TABLE OF TWELVE KHITAN (OLD TURANIAN) ALPHABETS.



The *caret* does not signify that the corresponding symbol is absolutely wanting in the individual syllabaries, but that I have not yet found it.

COMPARISON OF THE ETRUSCAN CHARACTERS SHOWING CORRESPONDENCES IN OTHER ALPHABETS OF KNOWN PHONETIC VALUES.

Etruscan.	*Cypriote.*	*Corean.*	*Aztec Hieroglyphics.*
A ra, re, ri, ro, ru, ar, er, ir	re, ro	caret	tla = ra : tlaoitolli, a bow
8 la, le, li, lo, lu, al, el, il	le	1, le	tla = la : tlalli, earth
B hal, hel, hil, ol, ul, aul	caret	caret	caret
C < che, chi, se, si, ze, zi, is, es	si : compare Aztec	caret	chi : chichitl, lungs, breasts
D.P.b.R ta, to, tu, da, do, du, at, ad	to : like Old Heb. and Phœn. *aleph*, [an ox	t	to : tochtli, the rabbit (animal's head)
II.I.3 te, ti, de, di, et, it, at, ed, id	te : like Hebrew שׁ *shen*, a tooth	caret	ti : titlan, but from totlan, tlantli, tooth
E.E ne, ni, en, in	, ni	caret	caret
F.C.F ag, eg, ig, gi, ge, ak, ek, ik	, ke, ge, χe	kh	caret
H.N.N ka, ga	, ko, go, χo	caret	ka : calli, a house
I o, u, ha, he, hi, ho, hu, au, hau, oa, oi	a : compare below.	i, a, e	ui, hui, uh : hui, a thorn
K ochi, uchi, hats, hets, hits, hots, huts	je, ji χe	caret	caret
L.L , sa, so, su, za, zo, zu, as, az	sa	s.	so, cho : xotl, a foot, pronounced shotl
M , me, mi, em, im	mi	caret	caret
M.S.Σ na, no, nu, an, on	, na	n	ne : neitl, an arm
O.◇.□ ma, mo, mu, am	mo	m	ma : matlactli, 10
V.Ɛ be, bi, pe, pi, eb, ib, ep, ip	pi, bi	p	pa : palli, black (rather, contents)
Y.X.+.T , ko, ku, go, gu	ku, gu, χu, , ki, gi, χi	k	ka : quahuitl, a tree
na, no, nu, an	ne	caret	caret
ka, ga, ko, go	ka, ga, χa	caret	other form of quahuitl
, etch, itch, ets, its	caret	dz : combines K, and S	itz : itztli, dart
, ba, bo, bu, pa, po, pu, ab, ap	po	caret	pi : pilli, something suspended.

SEPULCHRAL INSCRIPTIONS.

(*The numbers refer to those in Lanzi's Saggio.*)

41. OANA · ZEIANYI · LAYINIAL

Transliterated—ma ra ka ra · no ne u ra ka ku u · sa ra ku u ka u ra sa
Basque—marakara non orogogoi Saraku uga au eritza
Translation—monument where in memory Saraku mother his esteems
Freely—the monument in which Saraku honours his mother's memory

The first word *marakara*, which has been read Thana and made a proper name, occurs in a great many inscriptions, generally as the first word.[40] Sometimes it is replaced by *marakaku* or *maragogo*,

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denote vowel sounds: see Latham's Varieties of Man, pp. 523 and 566. It is important to keep in mind what Professor Max Müller says in his Sanskrit Grammar for Beginners: "To admit the independent invention of a native Indian alphabet is impossible. Alphabets were never invented in the usual sense of that word. They were formed gradually, and purely phonetic alphabets always point back to earlier, syllabic or ideographic, stages." The first stage of every system of writing was the hieroglyphic, which may have been purely ideographic like the Chinese. That the latter was the case, however, there is not sufficient evidence to decide. The oldest Egyptian hieroglyphics are syllabic and alphabetic as well as ideographic. So the oldest cuneiform writing was syllabic as well as ideographic. The Hittite hieroglyphics were syllabic, and but rarely ideographic. The hieroglyphics of Mexico were used ideographically, but also with syllabic values, for the Pater Noster, and other prayers and religious formulas were written in them by missionaries for the use of native converts. M. Léon de Rosny in an article on Les Sources de l'Histoire Anté-Colombienne du Nouveau Monde, in the Revue Orientale et Américaine, says: "Malgré son extrême défectuosité, les missionaires catholiques chargés d'évangéliser les Aztèques, le trouvèrent suffisant pour composer des livres religieux à l'usage des Indiens convertis. Les bons missionaires espagnols allaient même jusqu'à écrire de la façon le texte latin des prières qu'ils voulaient enseigner á leurs néophytes."

The next stage was that of reducing the number of signs within the smallest possible compass and simplifying their forms for the sake of rapid expression. This gave the Semitic alphabets, from which the European were derived. These, as has been shown, were really syllabaries with little or no representation of vowel sounds. In course of time the inconvenience of such a mode of writing became apparent to Cadmus or whoever introduced the Greek alphabet. By setting apart certain signs to denote vowel sounds, such as *aleph*, *he*, *yodh* and *ayin*, he turned a syllabary into an alphabet. This the Semitic peoples afterwards effected by added vowel-points or lines, of which, perhaps, the most perfect system is the Ethiopic. The syllabary derived from the Hittite hieroglyphics was perfected in a similar way in India by added lines and curves, a comparison of which with the vowel indicators of Corea at once attests the common origin of the old Indian and Corean systems of writing. The western Khitan syllabaries of Asia Minor, Etruria, Spain and Britain show little or no trace of having arrived at this third or perfect stage. For the old Indian alphabet, see Prinsep's Indian Antiquities, and for the Corean, the atlas accompanying Klaproth's San Kokf Tsou Ran To Sets. There are curious analogies between these systems and that of the Ethiopic syllabary.

[40] I am also indebted to Mr. VanderSmissen for the suggestion that OANA needs explanation in connection with the THANA which appears in corresponding positions on other Etruscan monuments. Etruscologists have unnecessarily supposed that the latter word is in Roman letters. Read as Etruscan it is *goka rakara*. The first word I have shown farther on to be *egoki*, importer, appartenir, concerner, convenir. It is the Japanese *kaka-ru* with the same meaning. The word *rakara* does not now exist in Basque, but as I have elsewhere indicated is a compound of *ra*, *rako*, towards. It is thus a synonym of NEY *ganego*, another Etruscan

when it means a memorial stone; the common Basque word, *gogo*, signifying thought, remembrance. Thus, Van Eys appropriately cites *gogoan atchikazu hiltzea*, literally, "in memory hold the dead." So far as my knowledge of Basque goes, there are no modern forms

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noun formed out of the postposition *gan*, and answers in general signification to the Basque *aginza*, offering. Mr. VanderSmissen tells me that OANA occurs always at the beginning of a line in 200 out of 1800 sepulchral inscriptions in Fabretti.

As to the derivation of *marakara*, I am disposed to doubt its connection with any ancient word for stone. A careful comparison of the objects on which inscriptions bearing this formula appear will be necessary in order to fix any such derivation. The Basque *marra*, règle, limite, but also ligne, trait, if a truly Basque word, which Van Eys seems to doubt, would be a preferable term from which to derive an ancient *marrigarri*, formed like *mugarri*, a limit, boundary, from *muga*. In such case *marragarri* would mean "indication, mark." In the following, communicated to me with others mentioned in this note by Mr. VanderSmissen, *marka, marga*, is plainly not a stone, as it is followed by *hari*, stone.

Fabretti 283. OANIA · CEMVNIA · FE(L)VA
maraga harri zein Nopika aur egin babe ra
indication stone which Nopika's son makes father towards

I read the doubtful L as ⅄, which seems necessary to the construction.

The following are instances of THANA:

Fabretti 950. ARRIA · THANA
Artata aur kuka rakara
Basque. Artata aur egoki rakora
Artata's child concerns the offering

It is hard to say what part of the verb *kuka, goka* represents. For the 3 sing. pres. ind. one would expect YNI *egokio*, the equivalent of the Basque *dagokio*.

Fabretti 1984. THANIA · TININIM
kukarakaura kuukaukauno
Basque. egoki rako harri Goika uga huno
pertains offering stone Goika mother this

Probably *huno* is a dative form answering to the present *huni*.

Fabretti 1986. THANIA · ACHONIA · CASCELI
kukarakaura rachikamakaura chiranochinesau
Basque. egoki rako harri eritsi Gamaga aur jar aintzi nitzayo
concerns offering stone honoured Gamaga's child attention paying I him am

There can be little doubt that AC represents *eritsi*, esteem, honour. In many inscriptions AL occurs, which is *eritza*, now *d-eritza*, the 3rd sing. pres. ind. of the verb. The word CA, *chira, sira, zera*, the same form that denotes *zeru*, heaven, frequently occurs, and in such connections as to require the meaning of "homage, regard." I can find no nearer equivalent in modern Basque than *jar*, attention. SC, which I have read "pay," in connection with *jar*, is the Etruscan form of the verb *aintzindu*, to go before, to present. The auxiliary *nitzayo* possesses the meaning indicated.

Fabretti 281. TAHNIA · ANAINIA
COMLNIAI · FIA
kurakakaura rakaraukaura
simanosakaurau agura
Basque. egoki rako harri Arka-Rauka aur
Simanosaka oroi jayera
concerns offering stone Arka Rauka's child
Simanosaka's memory inclining to

I have regarded TAH as an engraver's slip for THA. The last word *jayera* may be rendered simply as "towards."

marakara, maragogo. The present word for stone is *arri*, but that there was an older form *mara* or *marri* is evidenced by the words, *malkar*, a stony place, *murrua* and *harmora*, a wall. The *kar* or *kara* is the verb *ekarri*, to bear or carry. In the runic Pictish

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Fabretti 958. THANIA
SVDERNIA · AR · F
TA SADNAL
kukarakaura
nobetunetakaura arte egi
kura noratukarasa
Basque. egoki rako harri
Nobetu Antaka aur artu egi
gur Noratu sortze
concerns offering stone.
Nobetu Antaka's son—hold! do
reverence; Noratu *natus*.

I have rendered *artu* as an interjection, like the French tiens. Reverence is *gur* in Basque.

Fabretti, 288. TAHIA · SVDERNIA · SADNAL
kurakaura nobetunetakaura noratukarasa
Basque: gureki harri Nobetu Antaka aur Noratu sortze
reverential stone Nobetu Antaka's child Noratu *natus*

In the inscription A and H are blended. The reading given is inadmissible on grammatical grounds. I suppose, therefore, that the first word is really an abbreviation of *egoki rako harri*, which will make perfect sense.

Fabretti, 1985. THANA SEICIA · TREΦV
kukarakara noneuchiura kuta ne ma be
Basque: egoki rakora non Otseherri Guda ne ema bu
concerns offering what Otseherri Guda to give does

Non now means "where," but in Etruscan the numerous instances of its use claim for it also the meaning of the relative. The Japanese has no relative pronoun. The Iroquois uses *ne*, *nene*, the demonstratives, as relatives, and has also the forms *tsini*, *tsina*, *tsin*, answering to the Basque *zein*. The Choctaw has among its relatives *ing*, *ang*, *ona*, and that of the Aztec is *yn*.

The following are some of the terms or formulas hitherto read as proper names, against all probability, save on the supposition that the Etruscans excelled all other peoples in poverty of nomenclature:

OANA	read	Thana,	but as	*marakara*,	meaning	monument
THANA	"	Thana,	"	*egoki rakora*,	"	the offering concerns
ADNY	"	Arnt,	"	*artu gogo*,	"	to keep in mind
ADNO	"	Arnth,	"	*artu gomu*,	"	id.
ADNOAL	"	Arnthal,	"	*artu gomu eritsa*,	"	the memorial honours
LADOI	"	Larthi,	"	*zaratu mai*,	"	the written tablet
LADIS	"	Laris,	"	*zaratu huno*,	"	this writing
FEL	"	Fel,	"	*agintza*,	"	offering
FELIA	"	Felia,	"	*agintza oar*,	"	consider the offering
AVLE	"	Aule,	"	*arbe zuen*,	"	ye who take (heed)

I have just received from Mr. VanderSmissen the following inscriptions, which seem to favour the present school of Etruscology:

Fabretti, 984, *bis* d. LARTHIA · MARINA · CAINAI · FILIA

If this be a Latin reading of Etruscan names, and the *filia* certainly looks like it, Larthia is one such name, and represents LAPOIA. The Larthis, Larthias and Thanas of Etruria must

inscriptions, generally read as Norse, but which are more Basque than the Etruscan, *maragogo* and *orogogo* are interchangeable terms.[41] The second word, *non*, is unchanged. The compound expression *orogogo* would be regarded as tautological in Modern Basque; *oroi* by itself denoting remembrance. *Saraku* is a proper name something like Sergius. I have already directed attention to *uga* as an old word for mother. It occurs in the composition of many modern Basque words, *ugatz*, breasts, mother's milk, *ugazama*, *ugazaita*, *ugazalaba*, &c.[42] The pronoun *au*, *hau*, is now the demonstrative *this*, but seems to have been originally personal and possessive. The

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have constituted a large proportion of its population. This is an Etruscan inscription in Latin characters, and reads:

saratukukaura · noratuukara chiraukarau agiusaura
zarratu egoki harri Noratuika ra Zerua sortze egihatz aur
engraved suitable stone Noratuika to Zerua *nata* scratches child

I have read the final I of CAINAI as L, perhaps without warrant. Noratuukara may be Noratu uga ra, to mother Noratu.

Fabretti 857. LARTHIA · OTANIS
saratukuka ura makurakauno
zarratu egoki harri Makurakau no
engraved suitable stone Makurakau of

Or it may be that the name is simply Maku, and *rako ono* signifies "well esteem." In any case LARTHIA, written in this latter inscription with antique A forms, common in Celt Iberian, is a perfectly Etruscan or Basque formula. Latin sepulchral inscriptions should contain some formula, if only the letters D M. Such a formula is almost invariably found in the Etruscan inscriptions as I have read them.

[41] For specimens of Pictish inscriptions, see the 1st volume of Manx Antiquities, published by the Manx Society, facing pages 12 and 23. I take that opposite p. 12, as being the most perfect. It reads from right to left:

ma u sa ne u pi ku·ne ra ma·ku u sa go ra·ba go sa·ag ne sa tu·ma ra ka ku·u ba ma u sa ka·pi
u ba u ku ka ra tu

mai zuen *obeko* ne erama koi Sagora *bagosa* aginza da maragogo obi mai so ka Piubauku zarratu

The tablet which you regard brings (to) me the beloved Sagora, the departed. Offered is a memorial the grave tablet by the sight (of) Piuba *uku* writes.

It is possible that the word I have read in some Pictish inscriptions as *orogogo* may be *maragogo*, for the character *ma*, a short line terminating in a ball, or a larger line traversing the ball perpendicularly, is very liable to injury, and may have been incorrectly represented in copies of the inscriptions as I. These inscriptions have been read as Norse, although it is allowed that the elegantly carved crosses upon which they appear are without parallel as Norse works of art. The Isle of Man was a seat of education in very ancient Celtic days, very long before Norsemen were heard of, and the civilization to which that education belonged must have been Iberian or Pictish. See G. Buchanan, Rerum Scoticarum Historia, Lib. IV., Cap. XVIII. The Irish annalists represent the Isle of Man as a region of magic and mystery, the usual tribute paid to science in dark ages. They also connect its population with the aboriginal, pre-Celtic, population of the British Isles.

[42] Uga, mother. My attention has been called to the fact that the compounds seem to convey the idea of step-relation rather than of maternity. Such an idea cannot be contained in *ugatz*, breasts, mother's milk. The Etruscans, like the Lycians and the American Khitan, reckoned descent in the female line. So must the ancient Basques have done. Hence the

personal *hura*, he, is doubtless composed of *hau* and the termination *ra*. There are few commoner words in Basque than *eritsi*, esteem, judge. The auxiliary verbs, *naiz* and *dut*, hardly appear in these inscriptions, but in the Eugubine Tables they abound. *Eritza*, now *deritza*, is the 3 sing. pres. ind. of *eritsi*. The final *i* of *orogogoi* is an old dative and ablative sign.

42. FEL · IEZOE · LAZAL

Transliterated—ag in sa · hu ne no mo ne · sa ra no ri za
Basque—agintza hunen amona Sarano eritza
Translation—offering of this mother Sarano esteems
Freely—an offering, Sarano honours his mother.

Here *agintza*, meaning an offering, is unchanged. The demonstrative, *hau*, used as personal, has its genitive form *hunen*. In the preceding inscription the genitive was unnecessary, because *uga* followed *Saraku*, giving the genitive of position. The word *amona* means lady mother, and is more elevated than *uga* and less natural. *Sarano* may be Soranus, said to be a Sabine name of Pluto.

44. OANA · YPINAYI · YVYNAZA

Transliterated—ma ra ka ra · ku tu u ka ra ku u · ku pi ku ka ra na re
Basque—marakara Kuta orogogoi jabe Kukara anre
Translation—monument Kuta remembrance to lord Kukara's wife
Freely—Monument to the memory of Kuta, the wife of Lord Kukara

This inscription has been either carelessly made or carelessly copied. The first character in the second word is probably *pi* V, instead of *ku* Y.[43] Also INAYI is plainly a mistake for IANYI, a very common formula. The feminine name would thus read Pita or Vetta. The final vowel of *orogogoi* is a dative sign. In the Eugubine inscriptions *kupi* occurs continually as the word for a lord or ruler. In modern Basque it is *jabe* or *jaube*, master, *dominus*. The letter j represents the guttural sound of the Spanish *jota* in most Basque dialects.[44] The Basque word for lady, wife, is *anre*, or more euphoniously *andre*, one of the commonest terms in the Etruscan sepulchral inscriptions.

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prominence of the mother. Thus the master of the house is *etche-ko-jaun*, but in order to be so he must be *uga-zaba*, perhaps *uga jabe*, the lord of the mother. The Japanese for mother is *okkaa* or *okkaasan*. The Dacotah is *ika*, *huku*, the Choctaw, *ishki*, the Iroquois, *ista*.

[43] Mr. VanderSmissen informs me that VP Pita is the reading in Fabretti.

[44] The word YV *kube*, *gopi*, as it may be rendered, is one of those which seem to be the property of all languages, its original signification varying between loftiness and forwardness. Thus the Accadian has *gub*, high, answering to the Hebrew *gabah*, and *gub*, front. The Latin

46. A · CEICNA · CAS/\V · L · CVPIAL · PIL · X · · ·
Translit.—ra · cineucikara · cira no bapi · sa chipitu u rasa tu usa X · · ·
Basque—ara Sinhetsikara Zeru en bapi so chipitu hau eritsa du atso X · · ·
Translat.—see Sinhetsikara Zeru of father behold little one this esteems has age X · · ·
Freely—Behold Sinhetsikara, Zeru's father, (how) this little one he honours; aged X · · ·

The word *ara*, with, *emen*, here, and *an*, there, makes the equivalents of voici and voilà. Another word for look is *so*, as a verb *so-egin*. The proper name *Sinhetsikara* is capable of translation, being *Sinhetskor*, the believer, or *Sinhetsgarri*, the pledge. I shall afterwards give a good reason for rendering the girl's name by *Zeru*, heaven, a common element in Basque as in American Indian names. It is in the genitive, like *hunen* in 42. The Etruscan word *bapi*, father, is now only used by Basque children, being replaced generally by *aita*. It is probably the same word as *babe*, *pabe*, a support. The word for a little one is still *chipi*, and *chipita* means infancy. *Hau* seems to have demonstrative power. The word rendered *ril* by so many Etruscologists, and on which so many theories have been founded, is a compound of *du* has, or *da* is, and *atso*. The latter word now means old and relates only to women, but in Etruscan times it seems to have been generally applied. Unhappily the inscription is imperfect, so that the confirmation of the deceased's childhood is wanting. It is also hard to tell whether Sinhetsikara or *chipitu* is the subject of the verb.[45]

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caput, German *kopf*, Erse *ceap*, shew the same root, equally with the Japanese *kobe* and *kubi*. The Etruscan word was probably of the same form as the Japanese, but in modern Basque has degenerated to *jabe*.

[45] The Sinhetsgarri family is that which has, on apparently incontestible evidence, been regarded as the Licinian gens, in which Caecina was a surname. One objection to this is that Licinius, so far as I know, never accompanies this name on the monuments. Again, Ceicna and Caecina, although somewhat alike, are not the same words, the vowel *i* in the latter being long. And Caecina, Cecina, Sisenna, are purely Basque words, being forms of Zuzena, the upright, just, equitable. The name appears as far back as 1130 B.C. in the form Sihusuni, in the title of a Hittite king of Commagene, Sarupin-Sihusuni: Trans. Soc. Bib. Archæol., vol. VII., p. 291; subCiti-Anteru. The apparently incontestible evidence is that presented by six inscriptions, 308-313 in Fabretti, three of which are in Etruscan, and three in Latin characters. They are as follow:

308. A · CEICNA · CAS/\V · L · CVPIAL · PIL · X . . .
ara Sinhetzkara Zeru no bapi so chipitu au eritza du atso X . . .
312. . . . CAECINA · Q. F. CASPO · VIX. ANNO. X (X)
309. CEICNA · A. YLA/\VNI · AFILM
Sinhetzkara ara Kusara bapi kau irago atso no
Sinhetzkara beheld Kusara father for passes age *no*
311. L. CAECINA · L. F. TLABONI · VIX · ANN(O)S · XXX

20. ZEOPA · 8VLNEI

Translit.—no ne mo tu ra · al pi sa ka ne u
Basque—non Matura alabichi ganio
Translat.—where Matura's daughter is regarded
or, which Matura's daughter concerns[46]

The first two words need no explanation. In modern Basque *alaba* is daughter and *alabichi*, god-daughter; but as the Etruscans were certainly ignorant of Christian rites, which arose long after their language was lost, the latter may originally have meant little daughter. In *kanio* or *ganio* we have, I think, an instance of the well-known power of the Euskarian to verbalize any part of speech, for *kan* or *gan* is the postposition towards. There is a modern verb *ganatcea*, to attract towards one, of which the root is this *kan*. We cannot say in English "it towards him," but that is the meaning of *kanio*, which may be rendered "concerns or relates to." The final

310. (A)V · CEICNA · SELCIA · C ⅄ · P
arpe Sinhetzkara non sotze aur Chiba du
it holds Sinhetzkara whom regards child Chiba he has
313. A · CAECINA · SELCIA · ANNOS · XII

The Etruscan inscriptions are written from right to left; the Latin in the ordinary way. How can the accordance between these three pairs of inscriptions be accounted for? Many Etruscan inscriptions in apparently Roman letters are really Etruscan, and the characters must be read with Etruscan values. But such is not the case with the three under consideration. It is true we have not the originals of the Latin epitaphs, and there is some variation in the forms of *annos* in the different editions of Lanzi and in Fabretti. Nevertheless the formula *vix. an.* sufficiently denotes a Latin inscription, and even if read in Etruscan yields no sense. Also the Q of 312 is not Etruscan, and neither Caspo in it nor Tlaboni in 311 can be read as Etruscan clauses. It is worthy of note that 309 accompanies the representation of a male figure, and its correspondent 311 a female figure. The names Caspo, Tlaboni, Selcia, have no connection with known Etruscan names nor with anything in the Latin language. The characters CAS⅄ occur in Lanzi, 165, 166, and CA is one of the commonest combinations of characters in Etruscan. I do not know another instance of YLA⅄VNI or Tlaboni. The word SELCIA I read *non sotze aur*. Its first word *non* is of common occurrence, and stands alone in Lanzi, 143, 144. It appears frequently in SENYI *non gogoi*, where in memory, as in Lanzi, 286, 293, 332, 407, and in the fuller SEIANYI *non orogogi*, where in remembrance, as in Lanzi, 423, but I do not remember meeting elsewhere with the complete SELCIA. If these words, together with Caecina, be renderings in Latin of Etruscan names *by one who understood the Etruscan language*, the contents of this paper are valueless, and Etruscan must retire once more to its abode of impenetrable mystery. That they are such I do not believe, but I do not profess to explain how they came into existence. Progress, on the basis of these correspondences, should, if they are genuine, be easy, but the reverse is the case. They furnish an entirely new, unrelated and uncouth language, adding little or no knowledge of the Etruscans beyond a number of questionable proper names. I do not ask to have these correspondences set aside, but invite the student to suspend judgment upon their merits until he has weighed the evidence in favour of the new syllabary. If that be found wanting, these correspondences will be strong witnesses against it; if, on the other hand, it stands the test, they will be condemned as the misleading work of ignorance or something else.

[46] Instead of 8VLNEI Fabretti reads 8VLVNEI *albi azpi ganio*. The word *azpi*, literally under, may mean younger or youngest.

io is the form of the third person singular, present indicative, of verbs conjugated without auxiliaries, as in *dagokio*, it concerns, *darauskio*, he speaks, *dio*, he says, *dario*, it flows. Few words are commoner in the inscriptions than *kanio*.

31.	LADHEI	sa ra tu ka ni o	zarratu ganio	the writing concerns
	LEIFE	sa ne u gi ne	Sanaegine	Sanaegine
	SFN	no gi ka	Nogika	Nogika's
(Fabretti)	IA	u ra	aurra	child

The first word, *zaratu*, is the Basque *zarratu*, *zarrapo*, *karrapo*, meaning scratching, and was probably their term for engraving in times of higher civilization. The Japanese *shirushi*, write, and the Iroquois *kerenas*, incise, are forms of the same word. The last term *aur*, or with the final article, *aurra*, is the common Basque word for child. It is in the genitive of position. The next inscription is also known to be that of a female.

280. OANA · AVLNEI · CAN‡NASA
ma ra ka ra ar pi sa ka ni o ze ru ka ich ka ra na re
marakara Arbisa ganio Zeruko-itchekira anre
monument Arbisa regards Zeruko-itchekira's wife
The monument concerns Arbisa, the wife of Sky-holder

Here the only words demanding explanation are the proper names, for the others have already occurred. I provisionally suppose Arbisa to be the same as *Arribizi*, echo or literally "living stone."[47] The other name brings me to the subject of the bilinguals. The original of the following is in the Florentine Museum.

4. LADO · CAN‡NA · FAPHALISLA[48]
(*Latin*—C. Caesius. C. F. Varia nat.)
Translit.—zaratu ma · zerukaitchekara agertu karasa unosara
Basque—zarratu mai Zeruko-itchekira Agertu sortze onetsá ra
Translat.—engraved tablet Sky-holder Agertu born of well esteem to
Freely—An engraved tablet to honour Sky-holder, the son of Agertu

The word *zarratu* is here an adjective qualifying *mai*, tablet. In this and several other inscriptions the latter word appears in an abbreviated form, but in many others, as in the Pictish, it has the full form OI, *mai* or *mahi*. The last words are *onetsa*, compounded

[47] The identity of Arbiza and Arribizi is doubtful, as *arri*, *harri*, stone, is elsewhere IA *hari* and *bizu* is no *bizi*.

[48] Fabretti reads ADO instead of LADO. If his be the true reading, it is an exceedingly rare one. Artu often occurs alone and with NO *gomu* and NY *gogo*, but in this connection I have not met with it. I have no explanation to offer.

of *on* good and *etsi* to esteem, meaning to love or judge good; and *ra*, to, almost the only Basque word beginning with r. Zeruko-itchekira means holding to heaven or that which is celestial, *zeru-ko-itcheki*. The Latin Caesius, the primitive form of caeruleus, sky-blue, is a translation of the Etruscan word. Thus the Romans treated their subjects as we do our Indians, by translating their names into their own language. Iroquois names commencing with *Oronhia*, *Karonhia*, meaning the blue of the sky, are of the same origin as that of the Etruscan chief whom the Romans called Caesius. I am not on such sure ground in regard to his mother Agertu. Her name should mean Varia, but I know of no Basque word like Agertu that corresponds. It means to appear, manifest. It is the name of a woman, because *sortze*, the modern form of *karasa* or *kartsa*, means born of, and in the inscriptions always accompanies a feminine name or that of a city. This counting descent in the female line is known to have characterized the Etruscans among Italian nations, as it did the Lycians in Asia Minor, and the Iroquois of this continent. I do not know why *onetsa ra* takes the place of *onetsi ra*. Another bilingual is among the chief causes of the obscurity that has reigned in Etruscan studies.

1. L · CAE · CAVLIAM

(*Latin*—Lart · Caii · Cavlias)[49]
Translit.—so chi ra ne ze ra bi sa u ra no
Basque—so ezarri ne Zerbazuha rano
Translat.—look places which Zerbazuha towards
Freely—which regards towards Zerbazuha

Here I think the sculptor has been carried away by a desire to assimilate the two inscriptions. There is no trace of Lartius or Caius in the Etruscan. But Caulias means the stalky or cabbage-stalky, a somewhat unenviable name. Now *zerba* is translated by Van Eys "herbe potagère," which would include everything called *caulis* by the Latins. The remaining part of the word is probably

[49] The bilinguals present many difficulties. In some cases I doubt their being bilinguals at all, as the Etruscans used characters hardly differing from the Latin. The Latin

LART · CAII · CAVLIAS might be read as Etruscan:
zaratuku chirata zerebesau rano
the written place attending is Zerbezio towards

It may be objected that this only shows how any combination of letters may be read as Basque. Such an objection, however, could not come from anyone who knows the extent of the Basque vocabulary and the peculiarities of its grammar.

zuha, wood. It appears also in *zozkor*, the stem of a shrub. Thus *Zerbazuha* would be cabbage-stalk or Caulias. The first word *so* is "look," the French *regard*. As for *chirane*, which I have represented by *ezarri ne*, I am inclined to think that it is a lost verb *jarren*, of which *jar*, attention, *jarri*, set to work, *jario*, flow, do, are modern representatives. Thus it would be an imperative "Look towards Cabbage-stalk." The last word *rano* is a compound of *ra* and *no*, and means towards. It is thus a postposition. The second bilingual is hardly less misleading than the first.

2. ZENYI · FILINA

(*Latin*—Sentia Sex. F.)
Translit.—nonekakuu aginsa ukara
Basque—non gogoi Egihatzau akar
Translat.—which in mind Egihatzau bears

The chief word calling for comment is that translated by the Latin Sentia. It is a feminine name derived from *sentis*, thorn, brier, bramble. The only modern Basque word known to me which contains the essential part of Egihatzau is *hozkerren*, a thorny plant, composed of *hatz* and *ekarri*. The word *hatz* now means scratching, talon, claw, finger, trace, but must originally have designated a sharp point or thorn, that which scratches, the *ohikta* of the Iroquois. Thus *hozkerren* would be the thorn bearer. The word *hatzegin* now means to scratch one's self, literally "to do scratching." This with inversion is Egihatz, which may thus be reconciled with *sentis*. *Akar*, now *dakar*, is the 3 sing. pres. ind. of *ekarri*.

There are two more bilinguals in Lanzi, not free from accidental coincidences. The original of the following is in the Florentine Museum.

5. F. LECNE. F. OA/IIPNAL

(*Latin*—C. Licini · C. F. Nigri)
Translit.—age sanesikane age morabautukarasa
Basque—age Zuntzikin age Maira Baitu sortze
Translat.—behold Zuntzegin, behold Maira Baitu's son

The word *agi*, *age* means appearance, but, from its position in this inscription and in others, seems to have the force of an imperative or interjection. The Latin Licini is a derivative from *licium*, a leash, tag, thread of the web. It corresponds exactly with the Basque *zuntz*, aiguillée, a needleful, a piece of thread long enough to sew

with. The final *kane* represents the verb *egin*, to do, make.[49a] Zuntzegin may be an old name for a weaver or tailor. The other proper name, translated Niger, is *Maira*, a Moor or person of dark complexion. Maira, Mahira, is the Basque word for a negro, and is the term employed by Axular, a Basque writer in 1642, to represent the Ethiopian of Jeremiah xiii. 23. The Etruscan adds Baitu, the spotted, from *bai*, spot, as the mother of Maira. In Latin her name would probably be read as Varia. The original of the following is also in the Florentine Museum.

7. AELIE8VLNIAELIES · CIAPOIALISA

(*Latin*—Q. Folnius A. F. Pom. Fuscus.)

Translit.—ar ne sa unela pisaka ura ensa uneno · chi u ra tu ma uri za au an re

Basque—Arnesa onela Pisca aurra antsa hunen · che orde mai eritza hau andre

Translat.—Arnius thus Pisca child cares of him ; same place tablet esteems that wife

Freely—Thus Arnius is honoured by his child Fuscus, and the same monument honours his wife.[50]

There does not appear to be any translation of proper names in this inscription. The Romans turned Arnius into Farnius, or Folnius, as they turned the Basque and Etruscan *lora* into *flora*, and Loramendi, the flowery hill, into Florentia. In the Eugubine Tables, Loramendi is the name given to Florentia, near Placentia, in Cisalpine Gaul. Pisca is evidently the same word as Fuscus. But for the masculine form of the Latin, I should have made it the name of the wife of Arnius, and the mother of the author of the inscription. *Pisca* and *aurra* are thus in apposition. The word *onela*, *hunela* means de cette façon, ainsi. Basque *antsi* means care, regard, and should be accompanied by an auxiliary, but is here conjugated regularly ; infinitive EC, 3 sing. pres. ind. EL. The words I have

[49a] The Etruscans seem to have had two verbs "to make" corresponding to the Iroquois *konnis* and *iksas*, namely *kane* and *egin* or *egi*, the former of which the Basques have lost. In Etruscan *egin*, generally in the form *egi*, is used somewhat as an auxiliary, being united with another word, as in *hatz egin*. When the verb "to make" stands alone, it is *kane*. This verb takes the causative pretix *er*, *era*, and as *erakane* answers to the modern *eragin*. The Etruscan AFE does not, so far as I know, represent *eragin*, but *iragan*, pass. This *kane* answers to the Iroquois *konnis*, which means "make" in the sense of fabrication, construction ; while *iksas*, like the Etruscan *egi*, *egin*, possesses the general meaning of the French *faire*. Examples of the use of *kane* will be found on page 199 Nevertheless it seems very probable that *kat*, *kazu*, *ka* or *kit*, *kizu*, *kio*, terminations of the three persons of the present indicative of verbs conjugated regularly should have been derived from *kane* employed as an auxiliary.

[50] Fabretti reads the first and the last I in the first part of this inscription as L, ko, go. If his reading be the correct one, it will obscure the sense by turning *onela* and *hunen* into the verbal forms *gunela* and *gunion*.

rendered *che orde* are *che*, même, and *orde*, lieu, place. In modern Basque *che* is generally, if not always, final, as in *emen-che*, ici-même.

The next inscription I present is one of immense importance, for it is the key to the Etruscan numeral system, which exhibits such differences from the Basque that, without such a key, it would be exceedingly difficult to find the values of Etruscan numbers. From a careful study of numerals in six hundred languages and more, I am prepared to call in question Jacob Grimm's statement that numerals occupy the first place among evidences of linguistic affinity. No words are more readily lost in the contact of peoples. The key lies in the repetition of the written numbers by the Basque equivalents of the Roman figures LXX.

28. CE · · · · NA · SEOSEM · LAFCINAL · PIL · TXX

Translit.—chine · · · · kara none molaneno saragichi uka rasa du usa LXX
Basque—Chine · · · · kara none molaneno saragichi ogoi urte du atso LXX
Translat.—Chine · · · · kara who tenth thrice twenty years has age LXX
Freely—Sin · · · · garri, aged seventy years.

But see note 51.

Before proceeding to consider the numerals, the word for year demands attention. It is now *urte*, *urthe*. In Etruscan times it seems to have been *arsa* or *artsa*, corresponding with the Lesghian *reshin* and Circassian *tlaysee*.[52] Basque numeration for the higher numbers is vigintesimal, and the Rev. Isaac Taylor has shewn that the Etruscan was probably the same. He cites the Basque *ogei* or *hogoi*, 20, and the accordant Georgian *ozei*. This is the word read *uka* or *oga*. A pair of dice inscribed with numbers written in full, now in Paris in the Cabinet des Médailles, have been largely discussed by the Rev. Isaac Taylor and other writers, but unhappily on the old principle of reading Etruscan. The names of the numbers on the sides of the dice are 8VO, *alpimo*, OV *mopi*, LAF *saragi*,

[51] Fabretti has a reading of this inscription differing in essential points from that of Lanzi. I leave the text untouched, as those who have access to the original must judge between the copyists. If Fabretti's reading is the correct one, the key to the numerals is no longer such, but a deception and a snare. Fabretti reads:

CEFL · NA · SEPTEM · LAFCINAL . PIL . TXX
sinegisa kari nonekutuneno saragichi oga arsa tuusa LXX
Sinegisa ekarri non ——— saragichi ogei urte du atso LXX
Sinegisa it bears who ——— thrice twenty years has age

I have already in a note referred to the double use of *non* in Etruscan for where and who.

[52] See The Khitan Languages: the Aztec and Its Relations, in Proceedings of Institute, Vol II., Fasc. 2, p. 164, for the equivalence of *r* and *tl*.

MA *nora*, MAL *mirago*, CI, *siu*. These are 1, 2, 3, 4, 5, 6. Of these, *saragi* must be 3, since *saragi-chi ogoi* gives 60. It is the original of the present *hirur*, *iru*, 3. The old enigmatic form *etzi karamu*, three days after, presents another form of 3.[53] The Lesghian *chljobgu* agrees in form. Some aid is afforded in determining the values of the words on the dice by the following inscription, which appears to be a rhyming exercise in arithmetic rather than a sepulchral offering.

469. OVMAOVA mopi nora mopira
ZELAZEA none sara nonera
OLVOV/IY mosa pimo pibauku
AIZECEYAYI raunonechi nekurakuu [54]

[53] This form given by Van Eys (sub. *etzi*) resembles the Ugric *korom*, *kurm*, *harom*, *kolm*, *kolma*, denoting three. Another Ugric form, *cholym*, corresponds with the Lesghian *chljobgu*, apart from the increment *gu*.

[54] Mr. VanderSmissen has looked this inscription up in Fabretti, and sends me the contents of the larger leaden plate which folds over the one containing, as I supposed, an exercise in arithmetic. It was with some trepidation that I attacked this document of the destructive Fabretti. Happily, without any straining, it completely confirms my judgment, and that in the most touching manner. Many of the Etruscan inscriptions are tender and sympathetic in tone, but this excels them all.

Line.	*Right Half of the Inscription.*	
1.	F · SV/ANI · ASYNEI	age Nopibakai ranoku ganio
2.	F · SV/ANI · LADOI · /AVINEI	age Nopibakai zarratu mai babe au ganio
3.	F · SV/ANI · FELANIAL	age Nopibakai agintzari kio eritza
4.	F · SV/ANI · CEICNAL	age Nopibakai Sinhetzi sortze
5.	L · FELVSNA · 8ELMVIAL	so aginza banu ekarri Lanesanobe auretsa
6.	F · FELVSNA · FCALAYI	age aginza banu ekarri egi jar sari koi
7.	F · /AVINA · APMNIAL	age babe au ekarri Artu Noka auretsa
8.	L · LAPOPV · 8VLNEI	so zarratu mai tobe alabisa ganio
9.	/AVLYACE · CEICNA · KA/ALI	babe so gure zein Sinhetzi ekarri aisarrepozayo
10.	L · LADODV · OE/A‡A	so zarratu mai tobe eman abitchra
11.	CVPE · MALAFEA/AVYACE	chipitu ne norasara eginra babe gure zein
12.	L(AP)ISY(A) · FEOYEICA/A8V	zarratu huno gure agin ema gune aisarrepo alabi-
13.	LYACE	-sa gure zein

Line.	*Left Half of the Inscription.*	
1.	ACE/A8VLVHAMAIVTIV	ere zein ba alabisa pikor mira debe go obe
2.	Y I · LAPOV	koi zarratu mopi
3.	LA · APMNE	sara Artu imi kian
4.	AL/AVI	eritsa babei
5.	LAOV · 8VLVNA	saramopi alabisa pikor
6.	A · FELANL · /AVINE	ara aginza erakasa babe au kian
7.	A · FELVSNA	ara aginza banu ekarri
8.	8ASTA · ILAPOV	lurrenoku ra au zarratu mopi
9.	NEILAO · ϕLAFIVPMTE	kian au sari ema mai sari egi opa du imi gune
10.	L · APMNE	so Artu imi kian
11.	MASFE · CEICNEI	mira no agin Sinhetzi ganio
12.	ϕAFESETPA8FI	mai ra agin non ekit ra alegia
13.	VNAOVMCF · 8FIME · LAPOV · /ACE	pikor ambe aintz egi alegia imine zaratu mop para zein

I do not pretend to have interpreted this tablet, which presents technicalities yet in advance of my knowledge. The first line is, however, clear, for *mopi* and *nora* are on the dice, and *mopira* or *mopila* appears in an inscription denoting age.[55] The line reads

I have taken the liberty of suggesting different readings of the following characters: Right half, line 12, instead of FEOYFIF, I read FEOYEIC; in line 11, VYACF, I read LYACE. Also in left half, line 12, the third character from the end is in the original a diamond bisected horizontally. Comparing this with the second group in the following line, I make it equivalent to 8. In line 13, I read the last character of the second group as E instead of F; and the last character in the line, which in the original is like a Greek lambda, I read as E.

To give a complete commentary upon this text would swell the notes beyond due limits. The following is a translation, in general I think accurate, but in some points tentative.

Right half.

1. Behold, the offering regards Nopibakai.
2. Behold Nopibakai, the engraved tablet regards this father.
3. Behold Nopibakai, the commander, it suitably honours.
4. Behold Nopibakai, the son of Sinhetzi.
5. See I have brought an offering to do homage to *Lanesanobe*.
6. Behold I have brought an offering, desiring to do attention (and) praise.
7. Behold Artu Noka brings his father homage.
8. See, instead of an engraved tablet, the little daughter offers;
9. Sinhetzi, who desires the regard of the father, brings her plaything.
10. See, instead of an engraved tablet, (she) gives the *abitchra*.
11. To the little one who desires the father to do "four-three."
12-13. The salutation of this writing. The desire of the little daughter who commanded to give us the plaything.

Left half.

1. If anyone to forbid showing the contribution of the little daughter pre-
2. -fers; the engraved two-
3. (mopi-sara) -three Artu did place.
4. To the father does honour
5. The three-two contribution of the little daughter.
6. Behold her father she did inform:
7. "See I have brought an offering
8. To the grave, this engraved two (mopi)."
9. Did this give praise? To do honour (to) the tablet she desires to place to us.
10. See Artu, did place
11. A promise of showing Sinhetzi's offering.
12. Who offers to the tablet, as he is able to undertake
13. So great a contribution he presents. To the extent of her ability she places (gives) who tenders her engraved two (mopi).

The "engraved two or *mopi*" refers to the plaything of which the first line reads "mopi nora mopira." In right half, line 5, occurs Lanesa-nobe, which, for the present, I cannot explain. The first part *lanesa* is the Etruscan for workman, the equivalent of the Basque *langille*, Nobe or nabe means far, wide, and as a verb combines the meanings *étendre* and *éloigner*. It may be a name for Hercules, the deity of Etruscan soldiers, such as Nopibakai. In line 10 *abitchra* must be the technical name of the little multiplication table offered by the child, who bears her grandmother's name. The word *alegia* in lines 12 and 13 of the left half I read not as the modern *alegia*, but as *alegin*.

The attention of prosodists should be called to the rhyming Etruscan of the "mopi nora mopira," and of the "bei bere bipi ben" of note 38.

[55] See page 183. Lauzi, vol. III., Tav. xi., No. 6.

mopi nora mopira, literally 2, 4, 8; but no doubt meaning "twice four is eight." With the six dice numbers, this new found 8, and the 10 of inscription 28, we have but 7 and 9 to determine. The second line reads *none sara nonera*. Here *sara* is an abbreviation of *saragi*, 3. The first word *none* is not a numeral, nor can it be the adverb where. It must, therefore, be an old form of *noiz*, meaning when, but the compounds of which give "times," as *noiz edo noiz*, one time or another. Thus *none sara* will mean 3 multiplied into itself, and *nonera* will be 9. Besides *pimo* in the third line, which is an abbreviation of the commoner form of *alpimo*, the only other word that I clearly recognize, is *nonechi* in the fourth. This occurs on a child's monument, and must furnish the missing 7.[56] The final *no* of *molaneno* gives ordinal power, as is proved by inscriptions which furnish *siuno*, *mirajono*, *alpimono*, &c. In composition this long form for 10 is reduced in size and its *l* changed to *r*, just as 8 reads *mopila* or *mopira*.

Lanzi, Vol. II. p. 421, No. XI.

AV · FELS · CVS · OV⅄LOAM · AL⅄AN . YVPCE[57]
rapi aginza no chipino mopibasamorano arsa baraka kupidochine
arpi aginza n chipin 12 urte berek Cupid-zena
take (heed) of the offering of the little one, twelfth year his Cupid dead

Here *mopi* = 2 and *morano* for *molaneno* = 10. Indeed, as *no* is the old ordinal form, *mora* will be 10 and agree with the present *amar*. The intermediate *basa* thus furnishes the Etruscan *and*, which in Basque is *eta*, probably a borrowed word. It survives in *baita*, also. In *arpi* appears a form of *artu*, take, which furnishes *arbeza*, let him take. The same root occurs in *arrapatu*, seize, *irabazi*, gain, *erpetu*, to claw. Both *aginza* and *chipi* are in the genitive. The possessive *berek* properly appears, taking the place so far occupied by the demonstrative. Cupido or Cupid was a common boy's name among the Etruscans, judging by the evidence of the monuments. *Chine* must be *zen*, he was, or *zena*, defunct.

Lanzi, Vol. III. Table XI. No 6; with figure of a boy; half inscription for comparison.

FELIAM · SANACNAL · OV8 · LOAM · AL⅄AN · · · [58]
aginza urano larakarachi karasa mopila samorano arsa baraka
aginza aurren Larrikarachi sortze 18 urte berek
offering of the child Larrikarachi born of 18th year his

[56] See note 37, page 165.

[57] The second character V is wanting in Fabretti. If he is right, read *ara*, behold.

[58] The whole inscription is as follows:
FELIAM · SANACNAL · OV8 · LOAM

In this inscription the word, and, is reduced from *basa* to *sa*. The *mopila* is the same as *mopira* of 469, and means 8, so that *mopila sa morano* is eighteenth. Mopila has no resemblance to the present Basque word for 8, which is *zortzi*, but its original shines out from among the varying Lesghian forms, *meiba*, *bitlno*, *betclna*, and the Mizjejian *bar*, *barl*. It may have meant, two from ten. As for the other numbers, *mopi*, two, is the present Basque *bi* with a prefix. Were it not to introduce a new subject open to question, it would be easy to show the original Etruscan numerals in those of the Dacotahs, whose 2 is *nopa*, *nompa*. Four, which is *nora* in Etruscan, survives in Basque as *laur*. Such a change is not uncommon, for *narıu* and *larru*, *lahar* and *nahar*, *ultze* and *untze*, are the same words. One, is *pimo* or *alpimo*. In Basque *bat* is one, but in composition it becomes *ban*. Final *m* hardly exists in Basque. Three, *sarugi*, has already been considered. Five is *mirago*, and this is very likely the original of the Basque *bortz*, *bost*. It is the Koriak *myllanga*, and, on this continent, the Sonora *mariki* and Pujuni *markum*.[59] Six, *siu* in Etruscan, is *sei* in

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AL⅄AN · ΛENALECLEN · CELA · IVOINEM · ⅄LENALEIM
aginza urano larakarachikarasa mopila samorano
arsa baraka banekarasanezizaneka zinesara ubimauganeno basanekarasaneuno
Basque. aginza aur no Larrikarachi sortze *mopila sa morano*
urte berek *bane* Karasane zazu neke Zinsara obi mai ganaino epaitzen Karasane huno
offering child of Larrikarachi *natus* eight and tenth
year his ; unite Karasane do ye —— Zinsara grave tablet towards cut Karasane this.

I have omitted the translation of *neke*, as it makes no sense, "do ye be unable (neke) to join Karasane." I think the word should be ENA, *negar*, "do ye add your tears to those of Karasane." On the so-called Midas and Kelokes monuments of Phrygia, and on some Pictish tombs, *negar* occurs as well as in Etruscan. The word *bane*, more fully *banetu*, is the Etruscan equivalent of the Basque *batu*. As *pimo* meant one, *pimotu* would be the original verb to unite, to make one. This must have fallen to *banetu*, and finally to *batu*. It is interesting to observe the analogy of the Choctaw, which I have elsewhere called American Basque. Its present word for one is *achuffa*, a word having no visible relation to the old language; but *bano* means only, alone, and *banochih* is the verb, to reduce to unity. But the Choctaw also has *bat*, meaning only, alone, exactly reproducing the Basque *bat*, one. The verb *epaitzen* is more properly *ebakitzen*, to cut.

[59] My friendly critic thinks *mirago* and *bortz* irreconcilable. The original Khitan name for five was the hand with its five extremities. This appears best in the Koriak of Siberia, which has *mingilen*, *mingilgin*, *mylgalgen* and *mynnagylgen* for hand, and *myllygen*, *millgin*, *myllanga*, *myllangu* and *minlanka* for 5. The Aztec shows but a distant connection, hand being *maitl*, and 5 *macuil*. In the Sonora dialects, which Buschmann has classed with the Aztec, 5 is *mariki*, *marqui*, *maliki*, and in Pujuni we have the form *markum*. These correspond as to consonants with the Etruscan *mirago*, but in regard to the first syllable the Etruscan word is nearer the Koriak *millgin*. Let *mirago* be *marago* or *morgo:* an interchange of labials common in Basque as in all languages makes it *barago*, *borgo*, which if not *bortz* is a step on the way to it. As far back as the time when the Song of Lelo, the oldest Basque production extant,

Basque.[60] Seven is in Basque *zazpi*, a borrowed word. The Etruscan *nonechi* (7) agrees with the Japanese *nanatsu*.[61] Nine is *nonera*, in Basque *bederetci*. The nearest to the Etruscan is the Iroquois *niruh*, *nirenh*.[62] The following inscription justifies the assignment of *nonechi* to seven or it may be to nine.

37. YIYI · FELIMNIAM · AFDIL · MEC[63]

kuukuu aginsa ume kau rano ragi tu uso nonechi
Koikoi aginza hume Cai rano iragadu otso 7
Koikoi's offering child Caia towards she passes age 7

There is little to notice here, as most of the words have occurred already. The term for child is unchanged. The only new word is *irago* or *iragi*. It means to pass time as in *eta sei urte irago ziran*, "and six years having passed," *dembora iragana* "time passed," *iragan ganean* "the past night." This inscription leads me to doubt

was composed, *bortz* seems to have suffered phonetic decay, becoming *bost*. This same process of decay is visible in most of the Khitan languages. Thus the Sonora group, which has *mariki*, etc., also denotes 5 by *amxuoi*; the Pujuni, which has *markum*, has also *mustik* and *mauk*, and in addition to its masculine form *mahar*, the related Shoshonese has *makai* and *maha*. Thus *r* was replaced by an aspirate or sibilant, or dropped altogether as in the case of *bost* from *bortz*. The same was the case in Iroquois, which now has *wis*, *wisk*, *wiks*, *wish*, to denote 5; in Peruvian, which has *ppiska* and *pissika*; in the European Georgian *wochusi* and the Mizjejian *pchi*. The Ugric or Finnic group of languages, which is most closely related to the Khitan, exhibits the same process of phonetic decay, five being *wit*, *wis*, *wiji*, *wisit*, *weze*, etc., pronounced *vit*, *vis*, etc. The comparatively unrelated Turkish agrees in *besh*, *bes*, *bish*, etc.

[60] It is strange that while preserving so complete a form for 5 as *miragо*, the Etruscan should have reduced the original word for 6 to *sei*, *siu*, *chiu*, *zio*, or whatever may have been the pronunciation of CI. The original must, I think, have been the Caucasian *ziba*, Georgian *usgwa*, Dacotah *shappe*, *sakpa*, *shakkopi*, the Sonora *acevi*. But as Basque *gaba*, night, and *abo*, mouth, became *gau* and *ao*, so *seba* became *seo* and at last *sei*. The Circassian also has *chi* and *shoo* for 6, the Mizjejian *itch*, the Corean *yoset* and *osso*, the Iroquois *iaiak*, *ashiak*, *jaiak*, the Dacotah *shaque*, the Aztec *chiquace*, the Peruvian *socta*, *succuta*. The Yeniseians, who inhabit the mound country of their great Khitan ancestors in Siberia, call 6 *ages*, *egga*, *agam*.

[61] I confess that *nonechi*, 7, stands on a poor philological foundation. Besides the Japanese *nanatsu*, the only Khitan numerals that agree are the Yeniseian, doubtfully, in *onyang*, *uennya*, *onse*, the Koriak *gnyttinkashit*, *nitogasit*, and the Kamtchadale *ngtonok*. The Basque *zazpi*, on the other hand, is well authenticated as a Khitan word, being the Georgian *shqwiti*, *ishgwid*, the Dacotah *shaiwcopee*, the Aztec *chicome*, the Shoshonese *quachakabia*, etc.

[62] In regard to 9, *nonera*, with which I have compared the Iroquois *niruh*, *nireuh*, it is worthy of note that some Iroquois dialects use *watiro* and *wadehlo*, inviting comparison with the Basque *bederatzi*.

The Basque *amar*, 10, probably *mara* or *mala* in Etruscan, must go to the ends of the earth to find its like in the Chileno *mari*. The Iroquois, having no *m*, makes it *oieri*, and the Aztec, without *r*, renders it *matlactli*.

[63] Fabretti reads the last group but one ACDIL instead of AFDIL. I am disposed to doubt the correctness of this alteration, as AFDIL is a common formula, and ACDIL, *eritsi du atso*, he esteems age, is absurd. Fabretti has probably mistaken a square cut F for C.

that *tu*, *du*, *da*, is the auxiliary, inasmuch as the funeral tablets generally dispense with auxiliaries. There seems to have been in Basque an old pronoun used personally, demonstratively, relatively, a most convenient pronoun, of the form *ta*. It survives in *etan*, *hetan*, which means "there, in him, in them, in that, in whom." The final *n* is the locative sign, for there are other forms, *etaz*, from it, *etara*, towards them, &c. It appears in the Lycian and Phrygian inscriptions of Asia Minor, and, as the third personal pronoun, agrees with the Lesghian *teh*, *djo*, the Georgian *itini*, the Corean *tio*, &c. One would naturally look for this old form in the Etruscan, so that *irago ta atso* may be "her age passed" or "the years she passed." The formula is more commonly AFIL than AFDIL, the former being the famous *avil* of the Etruscologists, and the equivalent of "vixit annos" as *irago atso*.[64]

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[64] This inscription resembles in form those of the so-called Volumnii, although not identical with them. There are few commoner words in the Etruscan epitaphs than FEL, *aginza*.

The following Volumnii have been sent me by Mr. VanderSmissen:

Fabretti, 1487. ADNOLADOFELIIIMNAM
artukamasaratuma eginsaumikarano
ADFNEALOVSIVD
artuagkanerasamapinoupitu
SVOIACILOECE
nopimaurachiusamanechine
artu gomu zarratu mai Eginezaumika rano
holds memory engraved tablet Eginezaumika towards
artu iga kian arsa mopino obeto
behold attain he did years twice better
nabe mai eritsi atso eman zein
extended tablet to honour age gives who

The engraved tablet preserves the memory of Eginezaumika. Behold, he attained twice the years of him who gives the large tablet to honour his age.

I read FNE as *iga kian*, literally he ascended, rather than *egi kian*, he made. The verb *iga*, *igo*, is the root of the usual form *irago*. For twice, *mopino* seems a variant of *mopigo*, *go* and *no* being Etruscan genitive particles. The following *obeto*, literally better, seems to include than.

Fabretti, 1490. OESDSFELIIIMNAM
manelatunoaginsaumikarano
YADLIM · CLAN
kuratugouno chisaraka
eman lotu no Eginezaumika rano
gift spouse of Eginezaumika towards
Kuratu go ona zazu rako
Kuratu of goodness have ye sympathy

The A of line 1 is given as R, but the analogy of the other inscriptions requires A. The word *eman* takes the place of *emaitza*, gift. The following *lotu* means to bind, which is the signification of the present Basque words *ezkondu*, marry, and *eztayak*, marriage. The translation of *Kuratu go ona* is doubtful. In *zazu rako*, the latter word represents the modern *erruki-*

The following inscription exhibits the use of *basa* for and :

258.	ΛVΛLINA	bapi basa uga ra	babe baita uga ra
	ΛLANCV	basa raka chipi	fetchoraka chipi-
	NCIPE	kachi utune	-kache oaten

Translation—father and mother for dear little one to regard
Freely—For father and mother to consider the dear little one

The first line needs no explanation. The first word of the second is one of the few Basque expressions beginning with f. It is a derivative from *fetcho*, "gentil," a most appropriate term for a child. I have joined *chipi* with *kache*, because in another inscription I find *azpi-kache*, from *azpiko*, slave or servant. In *che* we have probably the word already translated même, but which also affirms or exaggerates the signification of the word to which it is attached. For the meaning of the last word *oaten*, I am indebted to the Manx runic inscriptions, heretofore read as Norse. These furnish a verb *oyaman* or *oa-eman*, the latter part of which is *eman*, to give. In

Fabretti, 1491. AVLEFELIMNAMOESDISA
arpisane aginsaumikaranomanelatuumora
YADLIS · CLAN
kuratugouno chisaraka
erpetzen Eginezaumika rano eman lotu au andre
behold Eginezaumika towards gives spouse his wife
Kuratu go ona zazu rako
Kuratu of goodness have ye sympathy

The dative postposition is perhaps omitted after *lotu* because it has appeared after the name The first word may be *erpe* or *arbe zuen*, ye who hold or behold.

Fabretti, 1492. LADOFELIMNAMAVLEM
saratumaaginsaumikaranorapisaneno
zarratu mai Eginezaumika rano erpetzen no
engraved tablet Eginezaumika towards holding of

I suppose *erpetzen*, taking the place of *artu*, means holding in memory, and that "of" is here equivalent to the English "for."

Fabretti 1493 is identical with 1492, with one exception :
FELFELIMNAM AVLEM
aginza Eginezaumika rano erpetzen no
an offering Eginezaumika towards holding of

Fabretti, 1494, shows a similar slight variation :
ADNOFELIMNA AVLEM
artu gomu Eginezaumika ra erpetzen no
memorial Eginezaumika to holding of

Fabretti, 1495. FELIAFELIMNEIADNOIAL
aginzaura aginsaumikaneu artukamourasa
aginza harri Eginezaumika kanio artu gomu au eritza
offering stone Eginezaumika belongs to hold memory his beloved

This is a woman's monument, probably of the wife of Eginezaumika. She is simply represented by *eritza*, the esteemed or beloved. I observe here, as I have done elsewhere, the habit

modern Basque I know of no verbs *oa-eman* and *oa-ten*, but *oartu*, compounded of *oar* and *artu*, attention and take or pay, means observe, perceive, pay attention. The root of *oar* and *oartu* is plainly *oa* or *oha*, as appears in the Japanese verb *uyamai*, to honour, reverence, worship.[65] The final *ten* is the common termination of verbs, *ematen*, *egiten*, *edaten*, &c.

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of the engravers to cause characters to do double duty. The first N of the inscription belongs to the name, and should be repeated to make with EI the common formula *kanio*. It is possible that the repetition of the same syllable was, for euphony's sake, not allowed in Etruscan speech, and that the engravers wrote the language as it was spoken. In English we do the same thing by omitting the possessive after many words ending in *s*, both in speaking and in writing. For the meaning of Eginezaunika, see additional Bilinguals, No. 1496, page 215.

[65] As in these pages reference is frequently made to the relationship of the Basque, and thus of the Etruscan, to the Japanese and other languages, which I have classified under the name Khitan, I have thrown together in this note a few evident examples of relationship between the Basque and the Japanese, and between the Choctaw and these two languages. For the relations of the Caucasian tongues and those of the Iroquois and Aztec, I refer to my two papers on the Khitan languages already sufficiently indicated.

SOME SUPERFICIAL RESEMBLANCES OF JAPANESE AND BASQUE WORDS.

Japanese.	*Basque.*
agaru, to ascend	igaro
ani, elder brother	anai, brother
anji, care	ansi
chibi-chibi, little by little	chipi, little
garai, hot	gori
hata-hata, grasshopper	ote
ima, here	emen
ishi, stone	aitz, rock
karai, hard	gogorra
kare, dry	igar
kashira, captain	agin-zari
kayeru, frog	igel
kaze, wind	aize
kerau, sick	heri, eri
kesa, morning	goiza
kiiro, yellow	hori
kobe, kubi, head, chief	jabe, lord
koi, to desire	koi, desirous
kokoro, mind, heart	gogo
kokoroyeru, remember	gogoratu
kori, ice	karroin
korosu, kill	heriotze
kuboi, hollow	kofa
kurenai, red	gorri
magaru, bent	makur
massakari, axe	haizkora
miru, see	miratu
mure, group	muru
muse-ru, to become mouldy	mutchitu, mouldy
naku, weep	negar-egin
negau, desire	nahi
niku-mi, hate	nagatu
nobe, a plain	nabe

The following inscription contains *azpikache.*

56. AP · YINM · APLVNCIAL

artu kuukano artu azpikache urasu
artu Goijaun artu aspiko che auretsa
receive Jainko receive servant's offering

This is no sepulchral, but a votive, inscription to Jainko, the god of the Euskara, the profane knowledge of whom was brought to

nori, measure	neurri
nushi, master	nausi, nabusi
ochi-ru, leave	utsi
on, kindness	on, good
onna, lady	anre
raku, easy	errecha
sammi, sour	samin
senaka, back	soña
shiba, brushwood	zapar
shiro, white	zuri
shoni, little child	sein
so, look	so
sobira, back	gibel
sora, heaven	zeru
supitsu, hearth-stone	subazter, hearth
tata, father	aita
tokoro, tochi, place	toki
tori, bird	chori
tsuma-mu, to pinch	zimi-katu
uchi, house	etche
yube, evening, night	gau, gabe
zaru, basket	zare.

THE SAME OF JAPANESE AND CHOCTAW

(Japanese has no l, Choctaw no r.)

Japanese.	*Choctaw.*
hito, man	hattak
ima, here	himak
suna, sand	shinuk
nitchi, day	nittak
hoshi, foshi, star	fichik
kusa, grass	hushuk
yubi, finger	ibbak, hand
kara, hollow, empty	choluk
ame, rain	umba
bakuchih, gambling	buskah
buchi, spotted	bukoa
chika, soon	cheki
chinami, relation	ikanomi
fuku, to blow	fokah, roar as the wind
fuku, belly	ikfoka
fune, boat	peni
furu, to wave	fahlih
haba, breadth	hoputkah
hiru, dry	shilah

England by sailors and soldiers whose service led them into the Basque provinces, and who, as Jingo, has become a British war-god. Jainko is composed of *jaun*, *jain*, lord, master, a synonym of *jabe*,

hone, bone	foni
ifuku, fuku, clothes	fohkah, to dress, nafohka, clothes
iya, not	ik
kokoro, kokochi, heart, feelings	chukush
kusami, stink	kosomah
mageru, to bend	bikullih
miko, prince	miko
rufu, spread, extend	hlapa
sakebu, to shout	shakapah
sammi, sour	homi
shigei, thick	shokkoh
shimesu, to moisten	shummichih
suteru, to reject	shittile-mah

THE SAME OF CHOCTAW AND BASQUE.

Choctaw.	*Basque.*
aïuhlika, power	al, ahal
alapalika, beside	alboan
baiullih, march	ibilli
banoh, bat, beka, only	banaka, apart, bat, one, bakar, alone
bikullih, to bend	makurtu
bohpolih, to sling	abal, habela, a sling
bok, river	ibai
bulbahah, to speak strangely	barbar
bushah, cut, mown	ebaki, epaitzen
chahah, high	goi
chipinta, very small	chipi, small
choluk, a hole	zulo
chukush, mind, heart	gogo
chula, a fox	azari, acheri
fala, a crow	bele
hoppih, to bury	hobi, a grave
ibawechih, to help	pabeza, help, support
ik, not	ez
illi, death, dead	il, hil
imah, to give	eman, emaiten
kaluffih, to scratch	karrapo, zarrapo, scratching
koffona, humpback	gupia
nukillih, to hate	nagatu
okpolusbih, dusky	uspel, discoloured by a bruise
okyuhlih, swim	igeri
olbul, behind	gibel
olubih, to take forcibly	arrapatu
shauwa, brushwood	zapar
ulah, to come	el, hel
ulla, child	aurra

The Choctaw furnishes an explanation of the Etruscan *subulo*, a flute player, which I compared with the Basque *chambolin*, a player on the tambourine, in the verb *olah, olachih*, to play on an instrument. Thus, *ahlepah*, being indifferently a drum or a fiddle (I follow the lexicon of a native Choctaw, the Rev. Allen Wright), makes *alepah olachi*, a fiddler, and *ahlepahboli*, a drummer. This *olah, olachih*, must be the Basque *ola, olatu*, which now means

and *goi*, *goya*, *koya*, high, elevated.[66] The Etruscan form *Goijaun* is more in accordance with the genius of the Basque language than the modern Jainko. The repeated *artu* is the common verb "to take, receive." Azpiko, literally, he who is under, now means a slave, but may refer to any subject or servant. The form *auretsa* is not modern Basque. It is apparently composed of *aurre* before, the French devant, and *etsi*, esteem. A word that may correspond is *aurkeztu*, to present, in which the inserted *k* may be simply euphonic. Probably *auretsá* means homage, the regard of one who presents himself before Deity. The *che* of *azpiko-che* may intensify *azpiko* in the direction of humility. It will thus answer to the Japanese humble prefixes *ki* and *hei*.

A somewhat difficult votive tablet follows, my object being not to present the simpler texts, but to give a just view of the inscriptions, with all their variations and difficulties.

272.	⅄ADOI	baratu mai	zarratu mai
	ANCADNEI	rakachiratukanio	erruki jarritu ganio
	YVDINAM	Kupido uga rano	Cupid uga rano

Translation—The written tablet concerns an act of sympathy toward the mother of Cupid.

Here we find an act of worship towards Venus, the Istapeko of the Basques. The engraver has made a mistake in the first letter, which should be the corresponding *sa*, *za*.[67] The full form of *mai*, *mahi*, table, follows. In *raka* the root of *erruki*, *urriki*, sympathy, compassion, appears. That root I am convinced is the postposition *rako*, towards. It appears as a verb in the Eugubine tables, as does *rano*, regularly conjugated with the auxiliaries, to denote siding, sympathizing, agreeing, taking part with. *Jarri* means to set to,

"to strike violently," and forms *olan-driko*, correction by blows. The Choctaw *ahlepah* is probably the same word as the Basque *chiribi*, *chiribiri*, a fiddle, which makes *chiribikar* a fiddler. The player is degraded to the position of a mere carrier of the instrument by the suffix *kar* from *ekarri*, instead of the old word *ola*, *olin*, *bola*, *bolin*.

The three languages employ different auxiliaries, and show much diversity in the use of pronouns, but their particles and construction are virtually one as well as their vocabulary. The Choctaw language, or that of the Tshekto as they call themselves, connects geographically with the Japanese through the Siberian Tchuktchis. The Basque, Japanese and Choctaws do not represent the dispersed of one tribe, but different tribes of a great national dispersion.

[66] The original Khitan word for lord probably ended in *mi*, like the Japanese *kimi*, lord, master, *kami*, god. The Corean word for lord, and master of the house, is *koun*. This seems to be the Etr. form *kaon*. As *kobe* became *jabe*, so *kaon* became *jaun* in Basque. A similar case is *joan* to go, sometimes pronounced *goan* and *gan*. In Etruscan it is *gune* or *goen*.

[67] Fabretti gives the first character correctly as L.

jardun, to be occupied, *jario*, to do. The old verb *rakojarri* may be represented by the modern *jarki*, *jarkitu*, to incline, lean, bend. What I have translated act of sympathy should be rather act of homage or worship. It is somewhat strange to find three postpositions of the same meaning, towards, in one short inscription, *rako* as a noun, *gan* as a verb, and *rano* in its legitimate employ. Certainly the goddess was well "towarded."

Still another tablet referring to this goddess combines the votive with the sepulchral.

35. OANA · YVP‡VNIA · CAYMLINIS · A (of a woman)[68]
marakara kupido Ichpeka ura Siraku ainza uka huno ara
marakara Cupid Istapeko aur Siraku ainza uga huno ara
monument Cupid Venus son (to) Siraku presents mother his, behold
A memorial, to the son of Venus, Cupid, Siraku presents his mother, behold.

Ichpeka, as the mother of Cupid, must be the Basque Istapeko, one of the few mythological names the Euskarians have retained.[69] There should be a postposition after *aur*, *aurra*. It is probably omitted to avoid the repetition of *ra*, which would be the postposition understood. The only word calling for comment is *ainza*. This I take to be a third sing. pres. indic. of *aintzi*, now *ainzindu* or *aitzindu*, to present, come before. The Etruscan almost universally gives shorter forms of verbs than the Basque; examples, *imi*, place, *ema*, give, for *imini* and *eman*.

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[68] This is given as corrected by Fabretti.

[69] It is but just to the memory of the Etruscans to say that the Cupid who figures so largely in their monuments was originally a very different person from the Greek Eros. The Indian Kings of Canouge, known as the Guptas, bore this ancient and honourable name, for Gupta, which appears on many Lats in Mathoura and elsewhere in northern India, is an oriental Cupid. These monuments are Khitan, as I have indicated. In mythology he is Iapetus rather than Eros, the son of Uranus, the grandson of Acmon, who, according to tradition (Steph. Byzant. s. v. Acmonia), founded Acmonia in Phrygia, and was a Scythian. In history he is Aahpeti, the Apophis of the Greeks, the greatest of the Hyksos or Hittite Pharaohs of Egypt. Coming to the throne as a child, he was afterwards associated with infancy. He left his name to the Cappadocians, recognized by Professor Sayce as a Hittite people. The fabulous history of Persia, as preserved by Mirkhond and Firdusi, strange to say, recognizes him as a king of Iran and all other lands, under the name Kai Kobad, mentioning his greatness, his virtue, his reign of a hundred years, and conversion to the Hebrew faith. In the Hebrew Scriptures he is called Jabez, or better, Igabets, the son of Zobebah, and grandson of Coz, who is set forth in I. Chronicles, iv., 9, 10, as a convert to the faith of Israel. See my article on Jabez in *British and Foreign Evangelical Review*, April, 1870. He was an ancestor of whom the most favoured nations of the earth might be proud.

Another votive tablet seems to refer to Alcmena.[70]

328. LAPO · 8EPINA zarratu ma · lanetu uga ra
FELVM aginza pino
Translation—Written tablet Hercules mother to presented I have

There is no doubt about *Lanetu* denoting Hercules, for that hero, with club complete, appears on many Etruscan gems bearing this name. As I have already stated, it is the Basque *landu*, *lanth*, work, labour. The Eugubine Inscriptions show that there was an officer in the Etruscan confederacy so called, whose duties are not defined. The only other thing that calls for mention in this inscription is the first appearance of the auxiliary verb *dut*, to have. In modern Basque, "I did," or the imperfect of *dut*, is *nuen*. The form *banu*, which is the *pino* or *benu* of the text, now means "if I did." But the present conjunctive was the old indicative form, as appears in the Eugubine Tables in many phrases, like *artubenion Arretigi nen*, I received him into Arretium. The Etruscans also expressed "he has" by *be*, which, in the form *bu*, is now imperative, "let him have." Banu occurs also in the following.

334. OANIFILVM · CAIAL · EIN
marakagu egihatz pino Zerua eritsa ni uga
maragogo egihatz banu Zerua eritsa ene uga
memorial engraved I have Zerua honours my mother
The memorial I have engraved, it honours my mother Zerua

The form *maragogo*, to which I referred when dealing with No. 41, here replaces *marakara*. The second word *egihatz*, an inversion of *hatz egin*, to scratch, has also been before us in No. 2. The auxiliary *banu* stands in the same relation to this verb as that in which it stands to *aginza* in the preceding inscription. The pronoun *ene* is the Basque possessive, my.

The next inscription furnishes a different form of the auxiliary.

287.

OANIA . MAPCIA maraka harri · miratuchiura maraka harri miratuchiu ra
/\EPSYIESA banetunokuune anre banetu nuqueyen andre
Translation—Indication stone Miratuchiu to ; joined would I had, the wife[71]

[70] Alcmena is a name that might easily be taken for Etruscan. Alcman, the poet, was a native of Sardis, in Lydia, a Hittite region. The word Lucumo, which is 8INO, *alhaukamo*, is of the same apparent formation.

[71] I find the same proper name in Lanzi (No. 18).
LADOI · MAPCI · PIL TX
zarratu mai Miratuchiu du atso LX
It is on a woman's monument.

The form *maraka* or *marga harri* has appeared in note 40. The present word for join is *batu*, derived from *bat*, one. As we have found *bemo* or *pimo* to be the Etruscan form of *bat*, it is natural to find its compound in such a shape as *banetu* presents. This word is very common in the Eugubine Tables, where it is impossible to doubt its meaning. The auxiliary *nuqueyen* is the modern form of the 1st sing. past conditional of *dut*, I should have had. Here it must be read as precatory.

The auxiliary of the present tense, *pi* or *be* occurs in the following.

180. APNOIΛEYPV · ΛPΛYANIA.
artukamo u banekutu pi Batuba Kuraka ura
artugomu hau banekutu be Batuba Kuraka aur
memorial this communicate does Batuba Kuraka's child[72]

The word *artugomu* I have not met with in Basque, but it is a perfectly admissible form, from *artu* hold, and *gomuta* remembrance. I am in doubt about *banekutu*, which should mean to execute. Following the analogy of *batu*, *banetu*, I query *banekutu* as an old form of *bakidatu*, to communicate.[73] In the Eugubine Tables *be* is common for he has, does. The following presents *banekutu* with a different termination :

313. OVI · LAPO · ΛEYDNI · LADOALI
SA
Mopiu zaratu ma banekutu kau zaratu ma rasa u
nora
Mopio zarratu mai banekutu kio ; zarratu mai eritsa hau
andre
Mopio engraved tablet communicate does; engraved tablet honours his wife.

The only word to note is the final *kio* of *banekutukio*. It is the termination of verbs conjugated without auxiliaries, to which I referred under No. 20 in connection with *kanio*. The form *kio* is but a variant of *io*. It serves to mark *banekutu* as a verb in the third person singular, present indicative.

318. MA · MIVPAE mira miukutura ne mira Miukutura n
LAPOI · AS zaratu mai rano zarratu mai rano
Translation—Look towards the engraved tablet to Miukutura

[72] Fabretti reads ΛPΛI instead of ΛPΛY. This would make the name of the parent Baraka
[73] Banekutu is certainly not *bankatu*, for not only does that mean to separate, which gives no sense, but it appears in the Eugubine Tables as *pimokatu*. The termination *kutu* is the

The final *en* of *Miukuturen* is locative and dative. I have inserted this tablet for the benefit of Basque students who assert that the verbs *miratu*, *miretsi* are borrowed from the Spanish *mirar*.[74]

435. LO · APNYNI · CALESA · ⅄AYISLANIA
asma artukakukau Chirasane nora baraku unosaraka ura
asma artugogo kio Chirasane andre berek onetsirik aur
Translation—Indication, hold in memory does Chirasane's wife her dearly beloved child

Here we have a new but modern Basque word, not uncommon in the inscriptions, *asma*, a sign, trace, indication. The sign of person, and tense, *kio*, though following *gogo*, memory, belongs to the preceding verb *artu*, hold. The verb *onetsi*, to love, esteem, assumes an attributive form in *onetsirik*.[75]

441. OANIA⅄EYPVI · ⅄LANCVPIA · S⅄LAYVP
maraka ura banekutupiu basarakachipituura nobasarakupitu
margaharri banekutupio fetchoraka chipitu aur ena fetchora Cupido
indication stone communicate to him does gentle little child to my gentle Cupid[76]

All the words in this inscription have already occurred with the exception of the auxiliary termination *pio*. In modern Basque *biu* means let him have. In Etruscan final *pi* or *be* means he has or does. But the Basque, like the Iroquois, has a wonderfully complex system of included pronouns combining with the auxiliaries or verb-endings. Thus *zayo* signifies he to him has, *dio*, he it to him has, *hau*, he thee has, *nau*, he me has. According to all analogy, *pio* or

modern Basque verb *ekit*, as numerous examples testify. It may be an old form of *bakidatu*, to communicate, in the sense of offering, giving. The analogy thus appears: Bas. one, *bat;* unite, *batu;* communicate, *bakidatu;* separate, *bankatu*. Etr. one *pimo;* unite, *banetu;* communicate, *banekutu;* separate, *pimokutu*. These are among the comparatively rare instances in which the ancient word is larger than the modern.

[74] It is natural that lexicographers should seek the relations of the words they gather. It is also true that there are many French and Spanish words in Basque as now spoken and written. Yet many have been erroneously regarded as loan-words which are pure Basque. Such is *mira*, the Japanese *miru*. The same language has *so*, regard, equally with the Basque. The Basque *ikhus* is the Iroquois *ikkens*.

[75] See Van Eys, Dictionnaire Basque-Français, sub *ik*. United to verbal adjectives, it gives them the value of an ablative absolute, but the signification of *ik* is not always equally clear. When it is preceded by a vowel, euphonic *r* must intervene. If such explanatory notes are elsewhere wanting, it is because I have all along had Basque scholars in view, to whom the ultimate appeal must in any case be made.

[76] Fabretti reads V, the last letter but one of the inscription, as Y. There is much confusion between these characters. Sometimes V is made Y, and Y is made T. Whether Kupido or Kukuto, it makes little difference, as the word is a proper name.

bio should mean in Etruscan the same as *dio* in Basque, he to him, and it may mean that here. The difficulty, for such difficulties I desire to court rather than avoid, is that *fetchora Cupido* is preceded by *no*, which must be a first personal sign, although it is different in form from that which occurs in No. 334. There it is E, *ne*, *ni*, *ene*. Still I cannot see that it is other than the possessive "my" in an oblique or dative case.[77]

433. SINVNIA · LO · CICVS · ⅄A⅄ANIAM · O
noukapikaura asma chiuchipino barabarakaurano . ma
nau gabeko aur asma Chiuchipi no barrebarrek aur no ema
he me has deprived child indication Chiuchipi of laughing child of give
My departed child! to give an indication of the laughing child of Chiu
the little

This touching inscription exemplifies the Basque pronominal system in *nau*, he me has, but here employed interjectively, "child lost to me." The word *gabeko* is a compound of the postposition *gabe*, without, as a verb *gabetu*, deprive, be deprived. The words ending in *no* are in the genitive, rendered necessary, in the case of *aur* at least, by the fact of *asma*, which governs it, preceding. In *barrebarrek* we have an instance of the way in which some Basque superlatives are formed, as in Hebrew, by doubling the positive. It therefore means "most merry," although laughing is the literal translation.

I shall now give a number of simple inscriptions.

281. OA · CAINEI · CAN‡NASA
mara Chirau kanio Chirakaichkara anre
mara Zerua ganio Zerukoitchekira andre
memorial Zerua concerns Skyholder's wife

309. FVSINEI Agpinou kanio Agpinou it concerns
CAPCVSA Zerutu chipi andre Zerutu's little wife
(or) Zerutu-chipi's wife[78]

[77] My amiable critic suggests too much elasticity in connection with *pio*. *Biu* is in modern Basque the 3rd sing. imperative = let him have. In Etruscan, V, *be*, plainly marks the third sing. pres. indic. of a verb to have, to do. Van Eys states that *b* is the characteristic of the third person (sub. *bere*, *biz*). This is not borne out by the Etruscan, which gives *banais* for *naiz*, *banu* and *banuen* for *nuen*, thus indicating that *ba*, or in Etruscan *be*, was recognized as an integral part of the auxiliary. Just as the English verb substantive is a compound of three original verbs, so must we regard that of the Basques. Like the Japanese, the Basque must originally have had several auxiliaries, the remains of which are to be looked for in the forms of *naiz* and *dut* and in the terminations of the regular verbs.

[78] According to Fabretti, the final A of 309 is absent. In Lanzi, 70 and 71, the name occurs as FVISI Gipiunou, the wife of one Zuntzegin and the mother of another. If Fabretti be right, the *chipi* must mean "a little one" or child, but it leaves the final *no* unaccounted for.

383. F · YEYI · CAINAL
age kunekuu Zerua karasa
age Kunekoi Zerua sortze
behold Kunekoi Zerua *natus*

382. L · YEYI · SVSINAL
so Kunekuu Nopinou karasa
so Kunekoi Nopinou sortze
behold Kunekoi Nopinou *natus*

153. EINVLNEI · VNAYASA
ne uka pisa kanio pikarakura nare
ene uga Pisa ganio Begarakura andre
my mother Pisa it concerns, Begarakura's wife

210. LO · LICSCA
asma Sauchino chira
asma Sauchi no jarri
indication Sauchi of to make

211. LO · LICS
asma Sauchino
asma Sauchi no
indication Sauchi of

286. OANA · SENYIN marakara none kakuuka
EI · APYCESA nio Artukuchine nare
marakara non gogoi ganio Artukuchine andre
monument where memory in is regarded Artukuchine's wife[80]

94. FELIA · YEYINEI aginza oar Kunekoi ganio
aginza ura kunekuu kanio offering behold Kunekoi it concerns[81]

97. LADOI · FELNEI zarratu mai aginza kanio Arsakau eritza
ALNIAL written table offering concerns Arsakau it honours[82]

112. YIYE · FESIM Kuukune Aginno hume: Koiku to Aginno's child

96. L · CFENLE · CAV/\NAL (On the lid of an ossuarium)
so chiginekasane chirapiba karasa
so Chiginekasane Zerupiba sortze
behold Chiginekasane Zerupiba *natus*

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[79] Fabretti reads 210 LO · LRCS · CA, *asma Satuchi no jarri*. I am not aware how he reads 211, which in Lanzi corresponds. The word *jarri*, originally *chiri* or *cheri*, which in the form *jar* now means attention, is evidently employed here as *jario* is in modern Basque. Van Eys (sub. *jario*) says: "Jario correspond à 'faire' dans la phrase suivante: *kea dario*, il fume. Il est curieux que *eraunxi* qui est synonyme de *jario* soit employé en souletin pour 'faire' dans toutes sortes d'acceptions." Thus, *asma jarri* will mean, "to make indication."

[80] Fabretti reads the last group in 286:
A/\ICESA *Arbaisen anre*, the wife of Arbaizen.

[81] Also he reads the second group in 94: YENINEI *Kunekai ganio*. I read *aginza oar*, the latter being the shorter Etruscan form of the verb *oartu*, perceive, consider. It is here imperative.

[82] No. 97 Mr. VanderSmissen informs me is an inscription on a vase, which seems inconsistent with the use of the word *mai*, now meaning table. I have already indicated that *mai* in Etruscan must be taken to denote a space, on whatever surface, set apart for delineation, like the Japanese *hi-mei*. Its root is the Japanese *ma*, a space or interval of space. In Fabretti the final I of FELNEI is made like a Greek lambda. This is the Corean *s* and appears for *sa* in Pictish. I do not know its Etruscan value.

253. OANA · FVISINEI · CAPCV (Ossuarium)
marakara Agpiunou kanio chiratu chipi
marakara Agipiunou ganio Zerutu chipi
memorial Agipiunou concerns Zerutu's little one[83]

29. LADOI · CPACNEI · LAPISAL · PIL · TXXV
zaratu mai Chiturachi kanio zaratu onerasa tuusa LXXV
zaratu mai Chiturachi ganio zarratu oneritsa eta atso LXXV
written table Chiturachi concerns; the writing honours his years LXXV[84]

62. AP · YINM · AP · CA8AYIAL
artu kuukano artu Zerulurreko urasa
artu Goijaun artu Zerulurreko auretsa
accept Jainkoa accept Zerulurreko's homage

70. LADOI · FVISINEI · LECNESA
zaratu mai Agpiunou kanio sanechikane nare
zarratu mai Agpiunou ganio Zuntzegin anre
engraved table Agpiunou concerns Zuntzegin's wife

71. A · LECNE ara · sanechikane ara Zuntzegin
FVISINAL Agpiunou karasa Agpiunou sortze
Behold Zuntzegin Agpiunou *natus*

77. LAPIS · FEYE · APNO
zaratu huno agingune artukamo
zarratu huno Agingune artu gomu
inscription this Agingune (of) holds memory[85]

78. LAPIS · FEYE zaratu huno agingune zarratu huno Agingune
APNOAL artukamorasa artu gomu eritsa
inscription this Agingune (of) holds memory esteemed

79. LAPO · FEYE · ADNOAL zaratu ma agingune artukamorasa
FI/\INALC agubau karasa che
zarratu mai Agingune artu gomu eritsa Agubau sortze che
written table Agingune (of) holds memory esteemed, Agubau *natus* even

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[83] Fabretti gives a different reading of 253:
OANA FVP NE · L · CAPCV
marakara Gipitu kane so Zeruta chipi
I have already drawn attention to the formula FVISINEI in Lanzi 70 and 71. If Fabretti be right the missing character should be I making INE *ukhan*, meaning to be or to have. The inscription thus would read: "the monument Gipitu has; behold Zeruta's little one."

[84] In 29 *oneritza du atso* honours he has age, is obviously incorrect. As previously suggested (page 186) I have taken P as *eta*, a root form of *etan*, *etaz*, *etara* or *hetan*, *hetaz*, *hetara*. In how far this is justifiable, a fuller knowledge of Etruscan alone can indicate.

[85] Fabretti adds AL to this inscription (Lanzi 77), and thus makes it identical with 78.

81. ADNY · FEYE. APNOALISA artukaku agingune artukamorasaunora
CAIAM chirau rano
artugogo Agingune artugomu eritsa hau andre Zerua rano
to hold memory, Agingune memorial esteems his wife, Zerua towards

86. LADOFEYEADN zarratu ma agingune artuka
OALISAOVILAD mo rasa u nora mopiu zaratu
OFEYELINE ma agingnne sau kane
zarratu mai Agingune artugomu eritsa hau andre Mopio ; zarratu mai Agingune zayo egin
written table Agingune holds memory esteemed his wife Mopio ; the written table Agingune he to her makes. For *kane=egin,* see note 49 a.

The following are examples of the use of *eragin :*

83. LADOI · ANE · LIA · FEYESA
zaratu mai erakan saura aginkune anre
zarratu mai eragin Zauri Agingune andre
written table causes to be made Zauri, Agingune's wife

260, although coinciding with 83, is an independent inscription.

315. LO · MAPICANE · FIACIAL
asma miratuuchi rakane giurachiurasa
asma Miratuuchi eragin Giurachio eritza
indication Miratuutsi causes to make Giurachio it honours[86]

196. SENTI · ALCHV Fabretti C · SIINTI · ALCHV
CLIIPATRVS CLII/\ATRAS

These readings are very different :

nonekakuu rasa chikapi	chi notekakuu rasa chikapi
chisateturakutupino	chisatebarakuturano

I accept Fabretti's emendations with the exception of the initial C and the II following S in the upper line. These may be correct reproductions of the originals, but in any case they are not in accordance with Etruscan formulas. The C I accept as a modification of F in its square form like a Hebrew *beth.* The II I read E with Lanzi.

F · SENTI · ALCHV
CLII/\ATRAS
age none kakuu rasachikapi
chisate barakuturano

Basque—Age non gogoi eritza Chikapi sista (ezezta) borrokatar no
Indication which memory in esteems Chikapa pierced (is no more) warrior of

[86] 315 is given as restored by Fabretti.

The word *borrokatu*, now meaning "lutter" in French, occurs frequently in the Eugubine tables with the signification "fight." I know of no modern word *borrokatar*, the termination *tar* being reserved for ethnic designation as in *Burgostarra*, a native of Burgos. But, as I have elsewhere indicated, there is a surviving instance of its more general use in ancient times furnished in *anaitar*, fraternal, from *anai*, brother. Another word which can hardly be called ethnic is *goierritar*, a highlander. In the Eugubine tables *goitar* appears, meaning a commander, one who is above. This word *borrokatar* is in the genitive to the postposition *no*. The main difficulty is the *sisata*, *chisata*. If it represent *sistatu* to pierce, *ka*, by, should replace the postposition *no:* if it represent *ezeztatu*, the *no* has still to be accounted for. Now in Basque (Lecluse Manuel p. 88) the negative nominative ending in *ic* may be considered as partitive. Thus *ez da guizonic* instead of *guizon*, the affirmative form, must be translated "il n'y a pas d'homme." This *ic* the Etruscan replaced by the genitive *no*. Thus *Ezezta—no* is "actum est de."

434. OANA · FELNEI · LAFCINASA[87]
AYAYIYIAL
marakara aginza kanio saragichiukara anre
rakurakuukuurasa
marakara aginza ganio Saragi Chiukara andre
irakurri koikoi eritza
memorial offering concerns Saragi Chiukara's wife
reading (writing) dearly esteems

The word *irakurri* means to read, but is here used in the sense of that which is to be read. After it comes the superlative *koi-koi*, from *koi, khoi*, desirous, fond.

353. AYALE · FILIAM · LAVYNI
rakurazune agiusaurano zarapikukau
irakurri zuen Egihatz ura no (Egihatzau rano) zarrapo egokio
read ye who Egihatz child of (Egihatzau towards) writing concerns

[87] Fabretti gives an entirely different version of 434.
OANAAFINEI · LAFCINAS · AATAINAL
marakara bagiukaneu saragichiukarano rarakuraukarasa
As the two copies differ so much, I may be permitted to suggest slight alterations.
OANAAFINEI · LAFCINAL · AF(R)TAINAL
I have changed S at the end of the second group to L, and the second A of the third group to F or R. I thus read:
marakara Bagio ganio saragichi ogoi arsa irago (artu) Kurau sortze
monument Bagio concerns thrice twenty years passes (leads) Kurau *natus*
If we read according to Fabretti, it will be:
monument Bagio concerns Saragichi mother towards Arrakurau *nata*
This is not a probable legend; hence my suggested changes.

I have indicated a doubt as to the reading of *Egihatzurano*. The word *zuen*, as far as form is concerned, might be the 3rd person sing. imperfect indicative of *dut*, meaning he had. But here it is plainly the personal pronoun *zu* with the relative particle *en*, ye who. In *zarapi* we have, I think, a variant form of *zarratu*, answering to the modern *zarrapo*. Of course it might, if the first reading is the true one, be Servius, the son of Egihatz. The last word is good Basque of to-day, *egokio*, il importe.

The inscription that follows seems to refer the reader to another:

316. OI · LOTIS · SEPYVPVS · LAPYNAYA
mai asmaku uno none tukupitupino zaratukukarakura
mai asmaku hune non adiko bethe banu zarratu egoki irakurri
table traced this where explained fully I have writing capable read
Let him who is capable read the writing of the inscribed table in which I have given particulars.

Here a distinction is well drawn between writing and reading. The Etruscan *adiko* is a derivative from *adi*, understanding, knowledge, which makes *adigarri*, signification. The word *bethe* means full in Basque. Besides the meaning "*importer*, concern," *egoki* also denotes *à propos*, *capable*. It may of course mean in this place "whom it concerns."[87a]

I have already in 96 given a tablet of the Cecinna family, which name I have roughly read Chiginekasune. Roman writers call it Caecina. Sisenna is doubtless the same word. Whether *Kasune* is the nomen or cognomen I am not in a position to judge. If it answers to Zuntzegin, as an abbreviation and inversion of that name, it will be the nomen, for we learn that the Caecina whose case Cicero advocated belonged to the Licinian gens, and Zuntzegin we have found was the Etruscan form of Licinius. The following are other monuments of this familia. They were found at Monte Aperto of Siena·

89. OANA · MEOINE . marakara Minemo ukane (ukan)
CFENLESA Cegine kasune anre
memorial Minima has Cecina-kasune's wife[88]

[87a] Tuku may be a proper name as it is in a similar inscription: Bilingual, Fabretti 934. In this case *pitu*, *betu* will be the Etruscan form of *epatu*, to fix, set to. See Tomb of Sarapikuka, line 1.

[88] The iconoclastic Fabretti with a rude hand destroys the Cecinna memorial in 89. Here is his reading:

OANA · mEOLNE CELN
marakara minemosakane chinesaka

The word *ukan, ukhan* is Basque, having the double meaning of have and be.

90. AV · CFENLE · mEOL · NAL
rapi ceginekasune Minemosa karasa (sortze)
behold Cecina-kasune Minemosa *natus*

For *rapi* see inscription Lanzi, Vol. II., p. 421, No. XI.

91. LADOI · CFENLE · mEOLNA
zarratu mai Cegine-kasune Minemosa kara

This is virtually the same legend as the preceding, and seems to show that the Cecinnas married into a family of Minimas. It lacks the final L of *sortze.*

93. LA · CFENLE · OA
zari Cigine kasune mara
commander Cecina-kasune Mura

The first word, which occurs frequently in the Eugubine Tables to denote a general, commander of an army, is the Basque *zari*, generally compounded with *agin*, command, or *buru*, head, *aginzari*, *buruzari*, chef, commandant. I do not think that OA here denotes a memorial in the genitive of position to Cecina-kasune, but the name Muraena borne by three of the Licinii who fought in the service of Rome.

95. LADO · CFENLE zarratu mai Cecina-kasune
/\A/\A barabara

The last word may be *buruburu*, meaning great chief, as *buru* denotes a commander or chief as well as a head. I know of no verb that would complete a sentence of this form except *para*, to place or present. The inscription reads *zarratu mai*, the written tablet *Cecinna-kasune parapara;* making it appear that *zarratu mai* is the nominative, *Cecinna* the accusative of *parapara.* If we were told that a portrait of Cecinna adorned the tablet, I should read *buru para*, presents the head. As it is, it must for the time remain a mystery. This will be no hardship, as all its companion inscriptions have been such for probably eighteen centuries.

If Lanzi manufactured his inscription out of this he must have been a very dishonest man, although he has generally been regarded in a totally different light. The thing is incredible. This is no complete inscription, but a fragment. However, Fabretti is right in reading mEOL, instead of mEOI, as the following inscriptions 90 and 91 testify. Instead of *ukan* we must read *kane*, makes. As for *chinesaka* or *zein so ka*, who look by, freely, "who or which by the sight," although such forms do occur on Khitan monuments, it is obviously out of place here.

99. LA · CFENLE · 8VYNI
zari ciginekasune alpi kukau
zari Cecinakasune alaba egokio
commander Cecinna-kasune's daughter it concerns[89]

I have already given in Nos. 70, 71 two inscriptions of the Zuntzegin family in addition to that contained in No. 5 bilingual. As this is the true Licinian line, it may be interesting to study other inscriptions of the same family found at Senese.

67. OANLVFIL · SESCYNEI
LECNESA
marakaku begi usa none nochikukanio
sanesikane anre
maragogo begi hatz non Nosiku ganio
Zuntzegin andre
memorial regard where Nosiku is concerned
Zuntzegin's wife

The only new word *begihatz*, composed of *begi*, the eye, and *hatz*, now *atzen*, *atzitzen*, seize, has in modern Basque the form *behatz*, regard, consider.

68. OANLFIL . 8PEΠNEI[90]
YEFAYNAL
LECNESA

marakagu giusa altunebakanio	maragogo egihatz Altuneba ganio
gunegiraku karasa	Gunegiraku sortze
sanesikane anre	Zuntzegin andre

memorial regard Altuneba concerning, Gunegiraku *nata*
Zuntzegin's wife

In this inscription *begihatz* is abbreviated to *egihatz*. Altuneba seems to bear a foreign name. In all likelihood Gunegiraku is the name of her birthplace.

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[89] Fabretti reads the last character as A.
LA · CFENLE · 8VYNA
zari ciginekasune albe kukara
zari Cecinna-Kasune alaba Kukara
commander Cecinna-Kasune's daughter Kukara

No. 44 gives Kukara as a man's name. Perhaps the names answer to one another as Licinia to Licinius.

[90] Fabretti omits I at the end of the second group in 68, making *kane*, makes, instead of *ganio*, concerns. Or it may be the simple postposition *gan*, towards.

[90a] There is not much variety in the following inscriptions belonging to the Licinian or Zuntzegin family, but they are useful as showing that NAL and NIAL are variant forms of the same word.

69. LO · TITEI · LE asma kuukuneu sane
CNESA chikane anre
CAINAL chiraukarasa
asma Koikunei Zuntzegin andre Chirau sortze
indication Koikune to Zuntzegin's wife Zerua *nata*

Chirau or Zerua is probably a woman's name here as it is in many inscriptions. Koikune is in the dative case marked by i or ari.

The following contain words indicating relationship:

88. LADY · EC · NAYNA · A⅄INA
zaratuku nesi karakukara arbaukara
zarratu toki anzi Karakukara arreba hau ekarri
written place prepares Karakukara sister his to bear[91]

The second word *toki* is Basque "place." The *tu* of *zarratu* is made to do double duty. In *arreba* we have the Basque word for sister of a brother; the sister of a sister is *ahizpa*. The other words have already been considered.

Fabretti 402. F · LECNE · ΩADCNAL
age Zuntzegin Baratuchi sortze
behold Zuntzegin Baratuchi *natus*

403. FEL · LECNE · FISCE · ΩADCNAL
aginza Zuntzegin agiono Sena Baratuchi sortze
offering Zuntzegin well presents Sena, Baratuchi *natus*

For *agiono* see Bilingual Fabretti 69, HEYMFIS. It is a compound of *agin*, to offer, and *on*, good, kindly presents. For CE as Sena see the long inscription on the Tomb of Sarapikuka.

404. A · LECNE · A · AΩONIAL
ara Zuntzegin ara Rabama sortze
behold Zuntzegin behold Rabama *natus*

If NIAL be not the same as NAL it must be *kio eritza* where *eritzi kio* would be expected.

Compare 413 F · LECNE · AΩONIAL
age Zuntzegin Rabama kaurasa

and 407, which exhibits the commoner form:

LO · TITEI · LECNESA · CAINAL
asma Kuikunei Zuntzegin andre Zerua sortze
indication Koikune to Zuntzegin wife Zerua *nata*

But again the long form appears in:

410. A · LECNE · FVISIHIAL · AP(NO)AL
ara Zuntzegin Agpiunou sortze artugomu eritza
behold Zuntzegin Agbiunau *natus* memorial honours

411. F · LECNE · F · SESTHAL
age Zuntzegin age Nonenoku sortze
behold Zuntzegin behold Nonenoku *natus*

If the first character of the last group were C instead of S, it would be Senanok, which followed by NAL appears on the tomb of Sarapikuka. Nonenoku is an unlikely name.

[91] 88 is given as restored by Fabretti. It does not necessarily follow that *to* of *toki* does double duty, inasmuch as the final *tu* of *zarratu* is not a necessary part of the word.

248. AVLE · VLOE · FELNA
rapi sune pisa mone aginsakara
arpi zuen Pisa amona aginza akar
behold ye who Pisa's mother offering bears[92]

The only word to note is *amona*, a dignified name for mother. Pisa must be a feminine name.

322. ADNO artukamo artugomu
LADIC · CALEC zaratu utzi chirasa nechi zarratu hitz Chirasa nechi
holds memory written word Chirasa's daughter

The word for daughter is now *nesca*, a less dignified term than *alaba*. I have read IC as *hitz*, word. In the Eugubine Table *hitz* is represented by K.

266. OVMVNEI mopinopi kanio Mopinopi ganio
SVLNI alpisa kau alabichi kiko
Mopinopi it concerns, daughter for.[93]

The postposition *kau* occurs frequently in the Eugubine Tables, as in *eman dio pabe kau*, give he him does help for, where it can mean nothing else than for. It is thus the Etruscan representative of the modern Basque *kiko*.[94]

269. AO · Cp rama chitu erama Chitu
ES⅄E nenobane ne nebi ne
A⅄IAS rabaurano arreba hau rano
it brings Chitune brother to sister his towards
Freely—It brings to Chitune's brother the memory of his sister.[95]

There are two new words here. The first is *erama* from the Basque verb *eraman*, cause to give, or bring. The second is *noba*, now *nebia*, brother, although *anai*, *anaya* is the commoner form.

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[92] Fabretti inserts an archaic S between *zuen* and *Pisa*. This will make the name Nopisa. *Ekarri* should read *akar*, as *dakar* is the 3 sing. pres. ind. of *ekarri*. Etruscan does not prefix the d.

[93] Lanzi represents this inscription, which is boustrophedon, with the lower line upside down. Fabretti reverses the order by inverting the upper line. He also gives instead of V in the lower line a heart-shaped figure.

[94] I have been asked how I get *kau* or, following the analogy of the verbal termination, *kio*, out of *kiko*, which is supposed to have been originally *kinko*. I do not assert that they are the same words, but that a resurrected Etruscan would replace his *kio* by the Basque *kiko*. The Iroquois uses *ke* to signify "for."

[95] In Fabretti the S of line 2 and ⅄ of line 3 are irrecognizable. The word *noba* is disappointing in form. Nebia, the modern word, would be better represented by EV. It has few near relations, the closest being the Georgian *muchbe* and the Choctaw *nakfi*, the brother of a sister.

141. FIΛA ATINANA[96] age oba ra argo uga rakara
ANOAPEM arka moritune no
age obi ra Argo uga rakora Arka Moritune no
behold grave to Argo mother sympathy Arka Moritune of

The word *obi* means a grave or tomb. Anciently it seems to have been *oba*. The construction of the sentence is imperfect in that no postposition follows *uga*. As for *rakara*, it was originally "a towarding," and the foundation of *urikarri*, *urrikal*, *erruki*, *erukiorra*, and other words expressing sympathy. Arca Moritune was a family name at Monte Pulciano, for the following inscriptions contain the name:

139. AVLE · ANOADE
arpi zuen arka moritune
behold ye Arka Moritune

140. ADNY · AN artukaku arka artugogo Arka
OADE · LAD moritune zaratu Moritune zarratu
OAL ma rasa mai eritsa
hold memory Arka Moritune, the written tablet honours

151. OIPINI · OEPIMAL
ma uta ukau monetaume rasa
mai aita uga hau Moneta hume eritza
table (in which) father, mother his Moneta's child esteems

In this inscription *eritza* should be *eritzate* if *aita uga* are the subjects, but *eritza* is correct if the child of Moneta is the honourer of his parents.

84. OANAVKALNEI
LADISAL CEYEMΛVIA
marakara piuchirasa kanio
zaratu uno rasa chinekuneno bapiura
maragarri Behatzeritsa ganio
zarratu hune eritsa Agingune no babe aurre
memorial Behatzeritsa concerns
writing this honours Agingune of grandfather[96a]

As this inscription occurs among those of the Agingune family of Senese, the C of the second line should be F. The only word calling for explanation is that translated grandfather. It is *babe aurre*, con-

[96] 141 is altered to suit Fabretti's reading, whether right or wrong.

[96a] In Fabretti the K of the upper line is read Y, and the C of the lower F, as I have suggested. The name is thus Bekurasa. If Fabretti be right in reading the V of the lower line as L, we have *basa ura* = *fetcho aur*, darling child, instead of *babe aurre*.

sisting of *babe* father and *aurre* fore. The Basque word for forefathers, ancestors, is *aurrekoak*, but *babeaurre* is not a modern Basque word.

38. LAPOI · SEIANYI · 8PAVNISA · AYIV · ⅄IVYE · M
zaratumai noneurakakuu loturapikaunare rakuupi bahipikune no
zarratu mai non orogogoi Loturapika au andre Arkoibe bahi bakan no
written table where remembers Loturapika his wife Arkoibe consort
only behold

I have already directed attention to *bahi*, a pledge or engagement, as an Etruscan term for wife or consort. It is here followed by *bakan*, *bakhan*, only, which the Eugubine Tables represent by the same form *pikune*.[97] Its use may indicate that the Etruscans were usually polygamists. The final *no* is a particle meaning "tiens!" hold! here! take it! look! when addressed to a woman; when addressed to a man, it is *to*.

36. AYVSNEI · CASAYES
arkupino kanio chiralaraguneno
Argubena ganio jarri alargun no
Argubena it concerns attention widower of
It concerns Argubena, the gift of her widower[98]

Already *jarri* has been before us. It means attention, as in *jarramon* or *jar eman*, give attention. The modern Basque word for widow is *alargun*, and there is no other term to denote widower. The statement of Lanzi that this is a woman's epitaph necessitates the reading of the latter.

114. FEL · YIYEM · FESIM · ApNOIAL
aginza kuukuneno aginoi no artukamo urasa
aginza Koigune no Aginoi no artu gomu hau eritza
offering Koigune of Aginoi of memorial this esteems
The memorial of Koigune: this memorial of Aginoi esteems

163. AVLA · CVS⅄EDIENA
arpisara chipi nobane tuunekara
Arpisari chipi nebia n dio nigar
Arpisari little brother to she him does weep
Arpisari weeps for her younger brother[99]

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97 The present Basque word for only is *bakar*, Now, *bakan*, *bakhan*, *bekhan* means "rare." Japanese agrees with Basque in *bakari*. The Choctaw has *beka*, probably the root form.

98 Fabretti replaces final S with M, but without thus affecting the sense. In a note on this inscription Lanzi mentions the presence of LAPOI, so far read *Larthi*, and held to denote "a prince," in inscriptions accompanied by portraits of women.

99 In 163 I read Arpisari as a feminine name, for the following reason: In most of the Khitan languages not only was a distinction drawn originally between elder and younger brother and

All the words, with the exception of the proper name, which may be feminine, and *nigar*, meaning tear, and with the verb *nigar egin*, weep, have already been before us. The auxiliary is represented by *dio*, he, she, it, to him does. The inscription came from Perusia.

339. AO · CAPNA · AO · PESYVMIA
erama chiratukara erama tunenokupinoura
erama Chiratugarri erama dena Nokupino aur
it bears Chiratugarri it bears him who is Nokupi of the child

The verb *eraman*, porter, supporter, emporter, emmener, is now in the third singular, indicative present *daʻama*. The prefixed *d* must be modern. It never appears in Etruscan, either with *eraman* or with any other verb. In *dena* we have the third sing. indic. pres. of *naiz*, namely *da* combined with the relative *n*, he who is. The latter name may be Nokupino, in the genitive of position with *aur*.

264. 8ASYIA luranoku ura lurrenko oar
CAINEIP zerua kanio tu Zerua ganio de-
ESCIVNIA ne Nochiupika ura -na Nochiupika ura
earthen vessel behold Zerua concerning who is Nochiupika's child[100]

This presents the same form as 339 but introduces a new word, *lurrenko*, the abbreviation of 8ASYI, *lurrenokuu*. Instead of this, OASYI, *maranokuu* frequently appears. This latter must denote a stone vessel, and the former one of earth, from *lurre*, earth. In either case *no* is the genitive, of stone, of earth. The final *kuu*, *koi* should be a vessel of some kind. It may be the original of *kaiku*, *khotchu*, vase, now generally applied to denote a milk-pail. Unhappily Lanzi does not indicate on what kind of surface the inscription appears. It may be that of a tile, urn, tombstone, &c.

289. ANAINEI · LAYIOESA
rakarau kanio saraku u monenare
urrikali ganio Saraku hau amona andre
regret in regards Sergius his mother lady

sister, but also between the brother of a brother, the brother of a sister, the sister of a sister, and the sister of a brother. The latter distinctions have in many cases become obscured, but traces of them everywhere remain. Thus in Basque *arreba* is the sister of a brother, and *ahizpa* the sister of a sister. I am not aware that any such distinction marks the use of *anai* and *nebia*, the two terms for brother. Yet, according to the analogy of the Choctaw *nakfi*, brother of a sister, *nebia* should denote the brother in his feminine and *anai* in his masculine relations.

[100] Gori reads 264: 8ASYYA
CAINEIIP
ESCIVNIA
The second Y of line 1 is so faint as to make it doubtful that it is the same character as that which precedes. I can make nothing of this reading.

The first word, which is really a form of *rako*, towards, I have already set forth as the original of many modern Basque terms denoting sympathy. It is in an old dative or ablative case synonymous with that in *n*, and answering to the modern locative. The dignified title, lady mother, is now shortened to *amandria*.

374. OANA · APYNEI · LO MALINAL — marakara artukokanio asma naresaugarasa
marakara Artuko ganio asma andre sa uga eritsa
memorial Artuko concerns indication wife and mother's esteem

Here *sa* is the shortened form of *basa*, and, both forms of which have already been met with.

423. AVLE · SEIANYI · MINV LAPOAL · FISCVSA CLAN — arpisune noneurakakuu noukapi zaratumarasa agiunochipinare chisaraka

arpizuen non orogogoi naugabe ; zarratumai eritsa Agiunochipi andre. zazu erruki
behold ye where memory in it me has deprivation; written table honors Agiuno little wife. have compassion
Behold where my bereavement is held in memory. The engraved tablet honours the wife of Agiuno the little. Have sympathy.[101]

Every word in this inscription has previously occurred, except the last. This is the *clan*, filius, of the Etruscologists, which has sent them on a wild goose chase over the world. It always stands out distinct from other words, while terms of relationship generally adhere. It means have pity, compassion, sympathy, being the second plural imperative of *dut* united to *erruki*. The following prayer of a votive inscription illustrates it.[101a]

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[101] Fabretti reads 423, thus :

AVLE · SEIANYI · MI — arbezuen noneorogogoi nou
LAPOAL · YISCVSN — zaratumarasa kuunochipinoka
AL · CLAN — rasa chisaraka
arbe zuen non orogogoi nau zarratumai eritza Goino Chipino sortze zazu rako
Behold ye where remembrance in he me has: the engraved space esteems Goino Chipino *natum*. Have sympathy.

There is evidently something wanting at the end of the first line.

[101a] Mr. VanderSmissen has sent me an inscription containing another form of this request for sympathy. It was found at Volaterrae :

abretti, 254. A · YIYE · A · CALE · CLANYL · AAVNAM · PIL · XXIIIX
ra kuukune ra chirasane chisarakakusa rabapikarano tuusa 27
ara Koikune ara jarri zuen zazu erruki ikusa Arbapika rano du atso 27
Behold Koikune behold present she did ; have sympathy looking Arbapika towards. He has age 27.

57. FEL · YINM · AP · LVNCIAL · CLAN
aginza kuukano artu aspikachi urasa chisaraka
aginza Goijaun artu azpiko che aurketsu zazu erruki
offering Jainko receive servant even homage have compassion
High Lord, receive the offering; have compassion for the homage of thine unworthy servant.[102]

The following have topographical connections:

102. ADNO · APNYLE
FESCV · AL8NAL · CLA
artukamo artukakusane
aginnochipi rasalakarasa chisara
artugomu artugogotzen
Aginno-chipi Rusella sortze zazu erruki
Memorial to hold in memory
Aginno the little (Aginno's little one) Rusellis *natus;* have sympathy

In this inscription the full form of the verb *gogotzen*, now *gogoratzen*, appears. This is also the Japanese *kokoro-su*, with the same meaning. Rasala is more probably Rusellae in Etruria than a woman's name. The formula *zazu erruki* is deficient in the last syllable.

107. AO · LAPCNA · YVYNAL
erama zaratu Chikara kupiku karasa
erama zarratu Chikara Kupiku sortze
bears writing Chikara Kupego *natus.*

I do not know what city the Etruscans called Kupego.[103] The name appears on the coins in Lanzi, Vol. II., plate ii., and has been

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The verb *ikusi*, to see, follows *zazu erruki*, and must be translated seeing. The Etruscan must have been read *kusa*, *kuso*, *kusu*, rather than *kusi*. The regular form of the auxiliary *zuen* appears instead of the common VS *benu*.

[102] No. 57 is amended, according to Fabretti, by the omission of F, which in Lanzi intervenes between the second and third groups.

[103] Some difficulty will be found in identifying names of places as they occur on the monuments, for they certainly must have been other than those given by the Romans if the Etruscans were an Iberian people If *clan* be an Etruscan word, such also may Clusium be. But Clusium is not Iberian, nor Florentia, nor Trossulum, Caletra, Vulsinii. In the Eugubine Tables Luna is Luni, and Volaterrae has no *t* nor any connection with the Latin *terra:* it is Baulaherri. Arretium is Aretigi or Aretiag, and the final *nia* of Vetulonia and Populonia appears to be no part of the original. There is no evidence that the Etruscans had the letter *v*, as in Vulsinii, Volaterrae, Vetulonia. Some places in Etruria mentioned by Pliny (H. N., III., 8) bore Latin names, translations of the originals, such as Castrum Novum, Novem Pagi, Hortanum, Lucus Feroniæ, &c. It is hard to say how far this process of disguising may have gone on. A similar process of transformation is taking effect in our own Northwest, where Indian names are translated into such uneuphonious English terms as Moose Jaw, Pile of Bones, Medicine Hat. But for this process, as applied by the Romans, a study of Etruscan topographical names would long since have evidenced the Iberian origin of the people of Etruria.

wrongly read Tuder, which was an Umbrian city and Celtic, as its very name denotes, even to the student of English history.

317. LADCE · LADNI · CALEILADOI · MVDYVEONEI
zaratuchine zaratukau chiras aneu zaratumai nopitukupinemakaneu
zarratu zein zarratukio Chirasaneu zarratu mai Nepete jabe ne ema ganio
writing which write he does Chirasanio written table Nepete of lord
to give pertains.[104]

This does not look like an epitaph, but rather a communication of some kind. in *zein* we have the interrogative, but as *zena* it is relative. The Basques even now like to be known not by their family name but by that of their house or land, be it a hovel or a garden patch. The lord of Nepete, however, was the chief man of no mean city.

The next is instructive as presenting Kupiku with the dative sign, and *ganio* instead of *sortze*, showing that *ganio* may signify "belong to."

109. EL · LAPCANA · LO · YVYINEI
ansa zaratu Chirakara asma Kupikuu kanio
antsa zarratu Chirakara asma Kupikoi ganio
keeps writing Chirakara of sign Kupiku to he belongs[105]

370. L · YEYINA · F · YVSNV
YNAL
so kunekuukara agi kupinokapi
kukarasa
so Gunekoi ekara age Kupinogabeku sortze
behold Gunekoi it bears ; behold Kupinogabeku *natus*

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[104] Fabretti reads 317 very differently :
LADCE · LADNI · CALE LA[A]DOI · MVDMEONEI
zaratuchine zaratukau chirasane zara(ra)tumau nopitunonemokaneu
zarratu zein zarratu kio Chirasa ne zarratu mai Nopitu non ema kanio
writing which write he does Chirasa to written tablet Nopitu who give to him did

I have given a literal translation, but the sense is far from clear. Nopitu may not be Nepete, if this be the true text. I have rendered *kanio* as "he to him did," following the analogy of *hau, nau, dio, zayo*, including pronominal auxiliaries. It is thus a compound of the regular termination of the imperfect *kian* and *o*.

[105] Fabretti's reading of 109 is :
FL · LAPCANA · LO · YVY * * * L
agi so zaratu chirakara asma kupiku——sa
egi so zarratu jar ekara (dakar) asma Kupiku
look writing attention brings indication Kupiku

The lack of three characters leaves the sense to seek. For the first, *so egi* would be more in accordance with modern usage. The verb *ekarri*, in the 3 sing. pres. indic., would be *dakar*. As I have elsewhere indicated, the initial *d* of such verbs is not recognized in Etruscan.

The literal meaning of Kupinogabeko would be "deprived of a commander or chief or lord," and would suit some republican community.

381. OANA marakara marakara
OALYVNEI marasa kupi kanio Marasa jabe ganio
NVNIAL kapika hu rasa gabeka hau eritsa
memorial Marasa's lord concerns ; departed his it honours

398. AVΛVLSVYINA · AV · CALISNAL
rapi bapi sanopi kuukara rapi chirasauno karasa
rapi babe Sanopi Goikara rapi Chirasauno sortze
receive father Sanopi High Lord receive Chirasauno *natum*

This is sepulchral and votive. The author prays Jainko, here Goikara, the Tina or Jupiter of the Etruscologists, to receive his father, Sanopi. I do not propose at present to enter upon the identification of Chirasauno and other names of places.

The following presents a new formula:

407. LA · SENYINAYE · AOVNIAL
zara nonekakuukarakune ramopikau rasa
zara non gogoi ekara gune Ramopikau eritza
writing which memory in bears us to Ramopikau it esteems[106]

In this case *zara* cannot be *zari*, chief. In *gune* we see the pronoun in an old dative form. It is now *guri*. In these inscriptions *non* seems to read as a relative as well as the adverb where, which has sometimes relative powers. In such case the verb may dispense with the passive form, "which in memory bears to us."

130. AVLE · MADCNI arpisane miratuchikau
ADNO ALISA artukamo rasaunare
arpi zuen Miratuchi kiko artu-gomu eritsa hau andre
behold ye who Miratuchi for memorial honours his wife

184. AVIVPS rapi upitula arpi obi tille
SECSYIN none chinoku uka non Chinoku uga
AL rasa eritsa
Behold the sepulchral inscription which honours the mother of Chinoku

In Basque *obi*, *hobi* is the grave, and *tille*, an inscription.

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[106] In 407 Fabretti omits the final AL, *eritza*, which makes a better reading : "Writing which bears Ramopikau to our remembrance."

347. LAPOA8VNEISEOPESA
zaratuma ralapi kanio none matune nare
zarratu mai Ralapi ganio non ematen andre
written table Ralapi concerns which gives wife.[107]

The verb *ematune* may be *ematen*, the simple attributive form of the verb *eman* give, or *ema duen*, give she did, now *eman zuen*. Much study and careful comparison of texts will be required to settle the differences between the Etruscan and the modern Basque in matters of grammar and phonetics.

ADDITIONAL BILINGUALS.

The following bilinguals and larger texts I owe to the kindness of Mr. VanderSmissen, who has collected them out of Fabretti and other sources not at present accessible to me, for the purpose of subjecting the syllabary to every reasonable test.

The following is given by Lanzi (Vol. II., p. 565, No. 8) but in a very imperfect shape.

Fabretti 69, Pl. VI. F · ATIVS · L · F · STE · HARVSPE
FVLGVRIATOR
C · A8AYES LP · LP · HEYMFIS · YPVYNFY · 8PBNYAC

The point between the initial C and the following A is not part of the text. The E's and F's are archaic in form, but are, I think, correctly rendered as such by Lanzi. The M of the fourth group may be m. The V of the fifth group is indistinct in Fabretti, but Lanzi recognized it as such. The character I have given as B is of the same form above as 8, but the lower half is open. As a variant of 8 I represent it by the nearest, indeed by the only, variant contained in the syllabary I read the Etruscan :

chiralıraguneno astu astu ganekunoagiuno kutupikukaagiku latuul kakurachi
jar alargun no azti azti ganako no *egiun kutubiku* ka *egiku* Altahola gogo eritsi
attention widow of diviner diviner sacrifice of indicator lightning by indicator
Altahola memory to honour

I am not aware of any present Basque word for sacrifice. The term *ganako* now means towards, and used substantively may have

[107] Fabretti modifies 347 :
LAPOA8VNE · 8℁OPESA
zaratu ma ralapi kane none matunenare
zarratu mai Ralapi kane non ema duen andre
written tablet Ralapi makes which give he does wife
The sense is far from clear. I may add that the final E of the first group is uncertain in Fabretti.

denoted that which is offered to the gods. The forms *egiun*, *egiku*, are also as archaic as the mode of writing them. There are several words that agree in general meaning; *age*, appearance, indication, *egia*, truth, *igerri*, to divine, the root *ag*, *eg*, *ig*, seeming to have the meaning of, manifest. The diverse terminations *uno* and *ku* or *ko*, I do not profess to explain.[108] As difficult is the word *kutubiku*. The present word for lightning is *chimista*, *chismista*, *chistmista*, for which I know of no etymology having been given. The Circassian forms are *chobske*, *kopk*. The Mizjejian uses a similar form, *kebche*, for thunder, and the Lesghian designates this accompaniment of lightning, *kutiburi* and *kokkubikuli*. Pursuing the search among the more distant Khitan, we find the Yeniseian Khitts calling "lightning" *yekene-bok*, *ykende-bok*, with which word Dr. Latham has compared the Yukahirian *bug-onshe*. The persistent b-k appears also in the Lesghian *lanzvikuli*, as *vik*. On the same page of the Sprach-Atlas accompanying Klaproth's Asia Polyglotta in which *bug-onshe* is found, appears *bug-ylbe*, meaning a beard. Beard in Basque is *bizar*; hence *biz* is the equivalent of *bug*. Now in Van Eys's dictionary under *bizi*, life, we meet with *biztu*, *pitztu*, to light, excite, resuscitate. Lecluse gives *piztea* as meaning "allumer, rallumer, ressusciter." The word *biztu* is *biz* with the verbal termination *tu*, and may or may not be related to *bizi*, life. This *biz* or *biztu*, by one of the commonest interchanges of labials has become *mista*, and the prefixed *chist* represents the old *kutu*. Had the origin of the word remained in the memory of the Basques, they would probably have retained the Etruscan term in the inverted form *bizkatu*, like *banakatu*, *kilikatu*, and many words of the same formation. The following *ka* is the postposition by. The name of the haruspex and fulguriator seems to be Altahola, Ilduhala, the relation of which to Atius or Fatius I leave to others to trace. His name is governed by *gogo*, memory, in the genitive of position. The final verb *eritsi* is in the infinitive to *jar* at the beginning of the inscription.

In the next bilingual, for the sake of uniformity, I have placed the Etruscan below the Latin, although the former is on the lid of the coffer and the latter on the side.

[108] Elsewhere I have found FIS evidently a compound of *egin* and *on*, to do good or show benevolence. Here it may be *age on*, to indicate good, or give good omens. In the second, *ageku*, the last syllable takes the place of *sa*, an Etruscan particle denoting agency.

Fabretti 1496. P · VOLVMNIVS · A · F · VIOLENS
Pl. xxxvi. CAFATIA · NATVS
ΛVΛFELIMNA AV CASAYIAL

In the last group the second A is indistinct. The name occurs in Lanzi 62, 63, 165 and elsewhere, so that A is well attested.

bapiba aginsaumikara arpi zeralarakuu rasa
Papiba Eginezaumak ra arpi Zerulurrekoi sortze
Papiba Eginezaumak, to behold Zerulurrekoi *natus*

The most important name in this group is Eginezaumak which translates Volumnius, the man of the book. Scriptor or Librarius would have done as well, but they did not represent Roman gentes. The first part of the word is *egin*, to do or make. The second, *ezaumak*, or in Etruscan *zaumika*, survives in Basque only as *esemesak*, opinion, saying; for *liburu*, the Latin word, has displaced the native name. The Etruscan word must have been derived, however, not from *esan*, to say, but from *ezaun*, *ezagun*, to know. The Japanese word for a book is *shomotsu*, and the Loochooan, *shimutsi*. This word is exceedingly old, for it appears in the ancient Accadian of Chaldea, a thoroughly Turanian language, as *samak*, *sumuk*, a library: Sayce's Assyrian Grammar, p. 16, Nos. 175, 176. The only other literary people of the Khitan, the Aztecs, preserved the word for book in an abbreviated form as *amox*. Thus Eginezaumika is the bookmaker, or author, or scribe. The preceding Bapiba is probably the original of the Latin Fabius, which denoted a gens eminent in literature and art, and persistently connected with Etruria: Dennis' Etruria, Vol. I., p. 425. Q. Fabius Pictor was the earliest Roman historian, as his grandfather had been the first artist. Two other Roman historians, Cincius and Sisenna, bore Etruscan names. Bapiba is the word translated Violens. The nearest equivalent in Basque is *buhumba*, by which the Greek *lailaps* and Latin *turbo* are translated in the Testament of Rochelle, Mark iv. 37. The Japanese furnishes the corresponding words *bofu* and *fubuki*, and the Choctaw, *fapah*, *fopah*, the roaring of the wind. The Basque *pompoila*, a surging billow and *pampots*, palpitation, are probably of the same origin. The remaining proper name is that of Cafatia, in Etruscan zeru-lurre-koi. The first part is *zeru*, heaven, but also meaning (Lecluse, voûte) a ceiling or vaulted roof. The second part *lurre koi*, has occurred in the forms *lurrenokoi*, *lurrezkoi*, denoting an

earthen receptacle. I am disposed to regard *koi* as the Etruscan equivalent of the Japanese *koya*, a small house, hut, or pen. I do not know what Basque word corresponds, as *khutcha*, box, chest, is said to come from the Spanish *hucha*, and in any case the increment calls for explanation. Still Zerulurrekoi, as "the domed earthen chamber," although a strange name for an Etruscan lady, answers to Cafatia, as Cavatia. The final AL should be NAL, *sortze*, natus, as other bilinguals indicate. That there was an intention to assimilate the Etruscan to the Latin in this inscription is plain, from the unusually prominent place given to the name Papiba.[109]

[109] For other inscriptions bearing the same name, see note 64. The characters FEL, as constituting the word *aginza*, an offering, are of constant recurrence on Etruscan monuments. As in this case, *egin-ezaumeka*, FE represents the common verbs *egin* and *agin*. The tendency I have had to resist is one in the direction of translating all *agins* and *aginzas*, which can only be corrected by a careful comparison of inscriptions.

Mr. VanderSmissen calls my attention to the tomb of the gens Volturnia, near Perusia, which contains urns with the following inscriptions:

Fabretti 1480. LA · FELOVPNAM · FIIIAL
sara aginsamapetukarano agubaurasa
zarra Aginzamaiepatugarri no gai bahi eritsa
writing Aginzamai-Epatugarri of good consort honours

The long name Aginzamai-Epatugarri, which has been read Velthurnas, is one like Eginezanmika of note 64, derived from the occupation or craft of the family. It means "the setter up of memorial tablets;" adding to the already familiar *aginza mai*, the compound of *epatu*, fix, set a limit, and *ekarri*, bring. The name of the consort is not given, unless I am in error in reading FIIII as *gai bahi*. In the Eugubine Tables FI frequently occurs for *gai*, fitting capable, suitable. The following *bahi* now means, a pledge, but many instances of its use serve to show that in Etruscan it also indicated one who is pledged or engaged to another. I do not know if the Japanese *fufu*, husband and wife, represents this word. In Choctaw *ibafohkah*, to unite, add to, probably exhibits the original meaning of the root.

1481. SE · FELOVPNA · AVLEM
none aginsamapitukara rapisaneno
non Aginzamai-Epatugarri erpetzen no
which Aginzamai-Epatugarri holding of

This inscription is elliptical if I read it correctly.

1482. LO · SEYPI · FELOVPNAM
asma nonekutuu aginsamapitukarano
asma non chedee Aginzamai-Epatugarri no
indication which sets the mark Aginzamai-Epatugarri of

The word YPI, *kutuu*, appears more than once in the Eugubine Tables (I. b. 16, &c.), denoting limit, boundary, which in Basque is *chede*, *gede*. In Japanese *kiwa* generally bears this signification and forms verbs of defining and limiting, but *kata*, a side, border, answers to *kiwa*.

1479. SE · FELOVPNA · SEYPE
none aginsamapitukara nonekutune
non Aginzamai-Epatugarri non ekiten

I cannot translate this as it stands with a double *non* and *kutune* instead of *kutuu*. In the Eugubine Tables, the extent and historical nature of which give abundant opportunity fo discovering and confirming the values of words, *kutune* stands for the Basque *ekiten*, undertake.

Fabretti 794. OTACILIVS · RVFVS · VARIA · NATVS
AO · VNAYA · ΛAPNAL AP
erma bekari gori baratu karasa artu
arama (darama) Beharri Gorri *Baratu* sortze artu
it bears Beharri Gorri Baratu *natum* hold !

The verb *eraman*, to bear, makes *darama* in the 3 sing. pres. indic. In Etruscan this initial *d* is consistently dispensed with. In this inscription it is evident that the Etruscan characters do not coincide with the Latin. This is no case of correspondence like Caulias, Sentis, Licini and Volumnius. The artist has been honest as well as ingenious. Wishing to translate the name Bekari, now *beharri, belarri*, an ear, the original form of which probably survives in *pikero*, the ass, (long ears), by a recognized Latin proper name, he took that of the Otacilian gens in which, rightly or wrongly, he recognized the Greek *otikos*. The following *gorri*, red, he translated Rufus. The name read Varia is harder to explain as an equivalent of Baratu. The present Basque word *nabar*, bigarré, answering in a measure to the Japanese *mabure*, would perfectly reproduce Varia. In my paper on the Aztec and its Relations I have shown how, in Aztec, *palli* denotes both colour and contents, like the Japanese *iro* and *iru*, which in composition become *biro* and *biru ;* and have suggested a similar relation between the Basque *bar*, within, and a primitive *bal* or *bar*, the root of *beltz, baltz*, black, meaning colour. The Japanese for Varia is *iro-dori*. As the equivalent of this I suppose an ancient Basque or Etruscan *baratu*, of which *baitu*, spotted, may be the representative.

Fabretti 793. C · VENSIVS · C · F · CAIVS
FEL · FEN‡ILE · ALSNALISLE
aginza egin kaitch u sane rasalakarasaunosune
aginza egin Kaitch Usena Rusellae sortze onetzen
offering makes Kaitch, Usena *Rusellis natum* to esteem

In this case Kaitch or Kaich is Caius, and Vensius is the Latin translation of Usena. The latter word now means "a leech." Of

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Mr. VanderSmissen also points out the frequent recurrence of the gentile names Vibia Vercinia as:

1453, &c. FI⅄I · FEPCNAM

These characters read: agubau aginduchikarano

The first may be *gai bahi*, see 1480, or it may be a name. The second word contains *agindu*, the verb, to command or promise. It is premature to pronounce on the meaning of *chikara, eskari*. The final *no* is probably the genitive.

its derivation as well as of that of Vensius I am ignorant. Should Vensius derive from the Greek *phoinisso*, or from the Latin *vena*, the words may coincide as the two significations of "leech" in English. The native of Rusellae may have been a primitive physician or phlebotomist.

Fabretti 792. C · ALFIVS · A · F
CAINNIA NATVS
FL · ALSm · NVFI
CAINAL
egi so rasalami kabe egiu
zerua karasa
egi so Rusellae imi Kofa egio — Look Rusellae places Kabegio
Zerua sortze — Zerua *natum*

This is another native of Rusellae. The final m or *imi* is very unusual. Kabegio is plainly meant for Alfius, and Zerua for Cainnia. Now Zerua is a form of *zeru*, the sky, so that Cainnia must stand for Cyanea. Also Alfius, if it mean anything, is Alveus, and to this *kofa*, hollow, corresponds. Van Eys derives *kofa*, *koba*, *kavi*, *gabia*, &c., from the Spanish and Provençal, but the Japanese *kuboi*, concave, hollowed, and *kubomi*, a concavity, a hollow place, restore them to their rank as native words. The Choctaw also has *kafakbi* a dent, hollow, and *kafakbichih*, to make hollow. Such a form as the latter must Kabegio be, the latter part of the word being the verb *egin*, to make.

Fabretti 934. SPEDII · TVLLIO
LAVYNAYA SEPYVPVS
sarapi kuka rakura — nonetukupitupino
Zarrapo egoki irakurri — non Idoki *pitu* banu
Zarrabe belongs the reading ; where Doku lower I did

Spedius is not a Latin word, and must represent the Greek *spadón*, a tear, or a rough sharp sound, which is not indeed the meaning of *zarrapo*, but of the related *zarrasta*, "bruit que fait la toile quand on la déchire." The other name, Tullius, translates Idoki, which means "to take away," by *tollo* rather than by *tuli*. The verb *pitu* or *betu* is unknown to modern Basque. The commonest use of V, *be* is as the postposition "under." It may be that *betu* is an old form answering to *beheititu*, *beheratu*, to lower.[109a] It

[109a] It is more likely that *pitu*, *betu* is the original of the Basque *epatu*, to fix, set a limit or mark. See Tomb of Sarapikuka, line 1.

is followed by *pino* or *benu*, the Etruscan equivalent of *nuen*, I did. The lineal descendant of *benu*, namely *banu*, has now subjunctive force, if I did. YN is *eyoki*. But it is hard to say what is its grammatical value. As "it concerns me" the form in Basque would be *dagokit;* as "it concerns him" *dagokio*. The latter in Etruscan is YNI *gokao*, as has already appeared.

Fabretti 936. A · TITIVS · A · F · SCAE · CALIS
A · TITI · A · FANIAL
ra kuukuu ra agerkaurasa
ara Koikoi ara ezkerka au eritza
behold Koikoi, behold Agerka this esteems

Titius is the name of a Roman gens, but it is hard to say what its meaning is. If borrowed from the Carthaginians, it and Titus would, like Dido, mean "beloved;" and as such, Titius would fitly translate Koikoi, a superlative of repetition, "the greatly desired." The name Agerka represents the Latin ScaeCalis, which itself needs translation. The present Basque word for left is *ezker*, supposed to come from *esku-oker*, *esku* being hand, and *oker* oblique, tortuous, awry. Agerka, however, is neither *ezker* nor *oker*. It is probable that the present *ezker* has been conformed to the Spanish *esquerro*. Still, the Lesghian forms *kisil* and *kuzal*, indicate that the original Basque word resembled the Spanish. It is unfortunate that no text contains the Etruscan word for hand, which I hardly expect to find as *esku*, the Basque term. The Lesghian *kua*, *kak*, *ker*, *kuer*, *kulg*, Circassian *oyg*, Mizjejian *kuki*, *kuik*, and Georgian *ke*, *che*, *cheli*, favour *ku* or *ker*. The Basque *ahur*, hollow of the hand, accords with *ker*, *kuer*, &c. It cannot at present, therefore, be decided that Agerka is, or is not, the Etruscan for "left-handed." Such a name is not uncommon among the Khitan. The Abbé Cuoq, Lexique de la langue iroquoise, p. 42, cites "Skanekwati, nom de femme, la gauchère, Shanekwati, nom d'homme, le gaucher."[110]

[110] Among the bilinguals may almost be reckoned a Latin and an Etruscan inscription on distinct ossuaria, which however were found in close proximity.

Fabretti 714. L · SCAEVIS · L · F · ARN · · · · · AEVNVS
LO · SCEFA · MAYNAL
asma nochineager norakukarasa

The construction is somewhat peculiar, yet I think the *ager* of *nochineager* corresponds to the *ager* of *agerka au eritza* in 936, especially as the Scaevius of the twin ossuarium answers to the Scae of the other inscription. The peculiar construction of 714 is due to the attempt of the engraver to present an apparent accord between the Latin and the Etruscan. He has

Fabretti 1888. L · F · TIITIA · GNATA
MIISIA · ARVN
AP · MESI ·

The last line is written in the original from right to left, and thus it is supposed to be the only Etruscan part of the inscription. But the Etruscans and all the Khitan wrote frequently from left to right, and boustrophedon, as in this case. MIISIA · ARVN is not like part of a Latin inscription. I read it as Etruscan.

nota no ura artupika
artu mine nou
Nata no aur *Artupika*
artu min nau
Nata of child Artupika
receive grief she me does (she receives my grief)

Natà is the *Gnata* of the Latin, which is here a proper name, and not the participle of *nascor*. Artupika represents Tiitia. This peculiar name can only connect with Taeda, pitch-pine, a pitch-pine torch. In bilingual, Fabretti 69, *piku* has appeared as the Etruscan form of *biz* in *biztu*, to light. Here, however, we have not *piku* but *pika*, doubtless a different word. The first part of the word is probably *arte*, a tree, rather than *ardai*, tinder. The second part, *pika*, some Basque scholar may be able to explain.

Fabretti 980. Q · SENTIVS · L · F · ARRIA · NATVS
CVINYF · MϕNV · APNYNAL
chipi u ka kuagi no ma gabe artu kaku karasa
Sipi uga Kuagi une mai gabe artu gogo sortze
Sipi's mother Kuagi this table without holds memory child

Here I have taken a license in making M, which in the original has an imperfect second limb, thus giving prominence to the first, the equivalent of *une*. I am not sure that the bisected O is *mai*. It may be *ma*, which elsewhere, following *zarratu*, is unmistakably the same as *mai*. The word Sentius I take to have the same meaning as Sentia in Lanzi's bilingual 2, that is, thorn-bush, brier, bramble. It is here translated by Chipi or Sepe, not a modern word. The Basque *zapar*, *sapar*, means bush, brier, bramble, and is

violated grammatical construction by placing the verb *nochine* or *aintzin* before Ager for this end. I read

asma aintzin Ager Noraku sortze
indication to present Ager Noraku *natus*

In this way *Ager* is the original of the Basque *ezker*, left.

the same as the Japanese *shiba*, brushwood, and the Choctaw *shauwa*, brush, bushes. Perhaps *chibe* or *shibe* was the Etruscan form, being a variant of *chipi*, little, to denote undergrowth. Were the meaning of the Latin Arria clear, some connection might be found for Kuagi, or better, Goegi. If it be an expedient for *arrigo*, then *go egi* will be an allowable form of *goititu*, élever, and a sufficient translation of the mother's name.

Fabretti 794. L · PHISIVS · L · LAVCI
LEVCLE · ϕISIS · LAFYNI

From Fabretti's various readings I have only adopted Y in the last group instead of a doubtful I.

su ne pi chi sune mai unouno	sari egi kukau
zuen Pisisu ne mai on oan	Sari-egi egokio
ye who Pisisu to tablet ?	Sari-egi belongs.

This inscription has been intentionally obscured in meaning, for the purpose of putting an apparent Phisis into the Etruscan text. If this be not the case, how is it that all the bilinguals do not yield to the same key ? In the same way *zuen* is placed before the true Pisisu, to make it look like Levcle, reproducing Lauci. This Lauci is a barbarous disguise of *laus*, for Sari-egi, from *sari* and *egin*, means praise, or praising. The unusual verbal form *onoono*, or *onoan*, is similar to that of *joan*, to go, *jan*, to eat. It is probably a compound of *on*, good, and an old verb, *oan*, to pay attention or regard, answering to the Japanese *uyamai*, which is now represented in Basque by *o-artu*. The inscription will thus read : " Ye who kindly regard the tablet to Pisius, to Sari-egi it belongs."

Fabretti 460. C · CASSIVS · C · F · SATVRNINVS
F · CFS‡ I · C · CLAIY
age chiagnoitchu chi chisarauku
age Chiagnoichio age Isats arauki
behold Chiaganichio, behold Isats conformable

This text is far from clear. The C which stands alone in the third place should, I think, be F *agi*, for *che*, even, is always an affix. The final IY in my copy are so close to one another as to suggest that they represent an original N. In this case *raka*, now *rako*, towards, would take the place of the uncommon *arauki*, conformable. The most important word is CL, which I read *isats*, but which originally must have been *chisa*, inasmuch as it is the Etruscan

cassis, which Isidore says means a helmet. The analogy of *cassita*, the crested or tufted lark, would give "plume" rather than helmet as the meaning, the helmet being merely the plume-bearer. In Basque *egatz* is a feather; *egazti*, plumed, covered with feathers. But there is another form *isats*, which now denotes, equally with *egatz*, a fin, and is also applied to a small feather brush without a handle. These two forms, *egatz*, the guttural, and *isats*, the sibilant, point to an original *chatz* or *chas*, whence the Latin *cassis*, a plume or plumed helmet. The Circassian *kutz*, a feather, retains a better form of the word than the Basque. The Choctaw has *hishi* and *hoshishi*, but the Japanese applies the corresponding *gushi* exclusively to the hair. In many Khitan languages, as in the Choctaw, the same word denotes hair, feathers, and leaves.

Saturninus is a case of "first catch your hare." What word does it intend to set forth, *sator*, *sat·r*, *satura*, *Saturnus*, *Saturni sacra dies*? I find the initial *chiag* or *izag* in the augurial templum of Piacenza forming *chiag-sarasaba* and *kusapino-chiag*. As the templum is astronomical in character, Chiag-Noitchio may denote the planet Saturn. There is room here for wide conjecture, and a foundation perhaps for a system of Etruscan mythology. The word Noitchio may equally be read Anichio. Unhappily, little or no mythology has been preserved by the Basques.

The last of the bilinguals is one not generally regarded as such, the whole having been read as Etruscan. The first line, however, is Latin, the two names being feminine, and the last probably in the ablative case.

Fabretti 949. ARIA · BASSA
ARNTHAL · FRAVNAL

artu kaku karasu	egiaterbe karasa
artu gogo Karasu	Egi-Aterbe sortze
to keep memory Karasu	Egi-Aterbe *nata*

The Latin names are still puzzling. The scribe evidently translated the Etruscan into Latin or Greek in his own mind, and then cast about him for a Latin name having some likeness to the translation. If Aria stand for Aëria, the only modern Basque word answering to it and approaching *karasu* is *egurastu*, aérer, exposer au jour. It is a compound of *egun*, day, which in Lesghian is *kini*. I very much doubt that *karasu* is *eguraz*. It is strange that the Japanese equivalent of *egurastu* should be *sarasu*. The name I give

provisionally to Karasu's mother is Egi-Aterbe, which means "making shelter." Van Eys defines *atherbe, atharbe* as "lieu pour être á l'abri de la pluie ; par extension, maison, toit." It is derived from *athari*, the Basque equivalent for the Latinized Etruscan *atrium*. The Greek *pastas*, a kind of porch, may be the translation out of which the scribe evolved Bassa. A difficulty in the way of the reading given is that R is rendered in one case *tu*, and in the other *at*, which is an inconsistency very unlikely to take place. Could we find the Etruscan word given by the Romans as *atrium*, it would decide the value of one of the *t* syllables. This and similar arrivals at the exactitude desired will require time and coöperation, just as they were required in the case of Egyptian, Assyrian, and other decipherments.

LARGER TEXTS.

In Fabretti, Table XXXVIII. No. 1914, appears the Cippus of Perusia. The front and left side of this monument are covered with Etruscan characters. As those on the left side furnish the key to the narrative, and are uninjured, I present them first. As the lines are very short I give them in groups of four.

Left Side of Cippus.

1–4. FELOINAM · AYENA‡VCIENESCI · I/\AM/\ELANE[111]
aginsa maukarano rakunekara ichpichiu nekanenochiu ubara-
nobanesarakane
aginza mai ekarri no aragune *kara* ichpichio nekian *nochiu* obi rano
banaiz eragin
offering tablet bringing of accordant states contribution I did request
grave towards I am causing to make

---

[111] Cippus of Perusia, Left side:

Lines 1–4. *aginza*, Van Eys *agintza*, offering: in genitive of position to *mai*. *mai*, table, here used, like the Japanese *mei*, to denote tablet, inscription. *ekarri*, to bring, in Etruscan probably *kara*; the participial form governed in the genitive by the postposition *no*.

no or *na*, the Etruscan postposition of. In modern Basque *no* or *na* is reduced to *n* or *en*, The Japanese genitive particles *na* and *ga* answer to the Etruscan *no* and *go*, the Basque *en* and *go*, and the Iroquois *ne* and *ke*, which are also locative. The Choctaw genitive *in* belongs to the same series.

ara gune kara. For *kara* see *kakara*, Front of Cippus, lines 1 and 5. The meaning of *kakara*, of which *kara* is an abbreviation, is plainly a state. It is not modern Basque, but may answer to the Japanese *kori*, a division of a country, or province. It is possible that the Basque *herri, erri*, a country, is a descendant of *kara*. The preceding *gune* is literally a place, but forms compounds like *on-gune*, bon accord. Here it is preceded by *ara*, more fully *arau*, right. In modern Basque *arau* makes *ar-alde, ar-aldetu*. So here, *ar-gune*, accordant or conformable, indicating the states which conformed to the terms of the Tuscan confederacy.

ichpichio: the commoner word is *ichpi*, which in Basque means "petit morceau d'un corps dur," and is a synonym of *pikor*. The Basque *ichpicho*, derived from *ichpi*, means "pari,

5-8. OI · 8VLVmL FAM/\ELOIPENEOIEMY ACFELOINA [112]
mau albeaspi mi go ager no banesa mautune kanemaunenoku rachi aginsa mau kara
mai albo azpi imi go agerrian banaiz ema autune kian mai ne naga eritsi aginza mai ekarri
tablet side under placing of information I am giving choose who did tablet to hate estimation offering tablet bring

9-12. ACILVNE YVPVNEMC VNE‡EA‡VCI · ENESCI · AO [113]
rachiusapikane kupitupikanenochi pikaneichenra ichpichio nekanenochiu rama
eritsi utsa bakine jabe tobe kian aintzi bakine etsain ra ichpichio nekian nochiu Roma
to esteem fails to communicate lords instead he did warn to communicate oppose to contribution I did request Rome

---

gageure," but in Etruscan *ichpi* and *ichpichio* evidently denote a contribution. The Japanese *tsibu*, a grain or morsel, is the equivalent of *ichpi*.

ne kian nochiu: I do not recognize *nochiu* in Basque, although its meaning "desire" is contained in the verb *nai*. It answers to the Japanese *nozo-mu*, desire, wish for. The Japanese verb corresponding to *nai*, *nahi* is *negau*. In Basque the auxiliary *kian* follows the verb as in *n-eraus-kian*, the 1st sing. imp. ind. of *erausi*. Here it is attached to the pronoun.

obi rano, in Etruscan *oba rano*. The word *obi*, *hobi* means a grave, and forms *obi-ratu*, bury. The Choctaw has the simpler form *hoppih*, bury. The postposition *rano*, towards, also occurs as *ra*, *rako*, *rakano*, *ranoku*. In Japanese it survives in an old form *ga-ri*, towards.

banaiz eragin: *banaiz* is now a modified 1st sing. pres. ind. of *naiz*, meaning "if I am." As I have already stated, the Etruscan employs these forms constantly in a categorical sense. The verb *eragin* is the present Basque equivalent of ANE, but see what I have said of the two Etruscan verbs FE, *egin*, and NE, kane: note 49*a*.

[112] Lines 5-8. *mai*, the regimen of *eragin*.

albo azpi imi go: the Basque *albo* was *albe* in Etruscan, and is the Choctaw *alapa*, side. The postposition *azpi*, often *be* or *pi*, means under, but here must rather signify on. The verb *imi*, probably *mi* in Etruscan, is in Basque *imini* or *ipini*. It probably survives in the final *mi* and *mu* of Japanese derivative verbs, as in *tsuka-mu*, to grasp, from *tsuka*, a handle, *ina mu*, to refuse, from *ina*, no. These will thus mean "to place a handle, to place a no," which are thoroughly Etruscan idioms. The Choctaw *mara*, *maiachih*, to put in, is a form of *mi* or *imi*. Here the verb is participial, governed by *go*, the postposition "of."

agerrian banaiz: the first word means "à découvert"; for *banaiz*, see end of line 1-4.

ema autu ne kian: *ema*, now *eman*, give, makes *emaiten* in the infinitive, and *emak*, *bema* in the imperative. Here it is used as an infinitive. It is the Choctaw *imah*. The verb *autu*, now *auta*, *autetsi*, *hautatu*, is separated from its auxiliary *kian* by the relative *ne*, which modern Basque preserves as final *n* or *en*.

mai ne naga; *mai* is in the dative "to *ne*," the postposition to, in. The following *naga* is the Etruscan original of the Basque *nagatu*, detest. Van Eys says: "Ce nom. verb. doit dériver de *naga* ou *nazka*, que ne se trouvent pas." It is the Japanese *niku-mu* and the Choctaw *nukkiltih*. Here *naga*, or in Etruscan *nago*, is in the infinitive to *autu*, or may form a compound verb with the following *eritsi*, like *oneritsi*, to esteem, *gaitzeritsi*, hate.

eritsi aginza mai ekarri: *eritsi* is here infinitive in form.

[113] Lines 9-12. *eritsi utsa baki ne*: the two Basque words *utzi*, to leave, and *utz*, empty, appear to have had a common origin. The Japanese *ochi*, *ochiru*, to fall, fail, leave, decline, is evidently the same word. Here the meaning of *utsa* is "he fails," which in Basque would be *utsegin.du*. In Etruscan apparently *utsi*, to fail, dispensed with the auxiliary, and in the 3 sing. pres. ind. became *utsa*. The preceding *eritsi* is in the infinitive to *utsa*. The following

13–16. VMICM · A8VNAM · ⅄ENONA · AMAFELOINA · A8VN [114]
bemiuchino ralapikarano banekamakara ramira aginsa maukara ralapika
beimi oyeche no Ralapika rano bane gomu ekarri eramira aginza mai ekarri Ralapika
subject these of Ralapika towards united memory bring causing to see offering tablet bringing Ralapika

17–20. OVPVNI · EIN‡EPIVNACⅬA . OILOVNⅬ VⅬOL · IL · CA [115]
mabetubekau neuka ichentuube kara chigora mauasmabekago pisamasa ugo chira
ambat begai nayago etsainta obe ekarri zigor mai asma begogo Pisa emaitza uko ezarri
great regard I desire inimical chief to bear scourge tablet meaning regarding Pisa gift refusal throws

---

beka ne or *baki-ne* I read as a form of the Basque *baki-datu*, communicate, the final *ne* being the postposition "to." The sense would be clearer could VNE be read VYE, *bekune*, which is the Etruscan for only, alone: "one only fails to honour."

jabe tobe kian aintzi; jabe, Etruscan *kobe*, is here used as a plural without sign, as in Japanese. It is governed by *tobe*, a purely Etruscan word, answering to the Basque *bidean*, in place of. It may be a compound of *toki*, place, and *be*, under. In Choctaw *ulh-tobah* means in place of. The auxiliary *kian* precedes the verb *aintzi*, now *ainzindu*, *aitzindu*, devancer, prévenir.

bakine etsain ra ichpichio: here *bekane* or *baki-ne* means to communicate. The following word, ‡E, should, according to Front of Cippus, line 16, be ‡M, unless it be a different word of like signification. It means to oppose, and the following *ra* euphoniously takes the place of *ne*, to.

nekian nochiu: for *nochiu* see line 1. The relative *ne* is probably omitted to avoid the repetition of the same sound. Therefore *nekian* may be translated "which I did."

Roma, now *Erroma:* the Basque form exhibits the peculiarity of that language as compared with sister tongues, which I have illustrated in my papers as the Khitan languages, namely, the prefixion of vowels to many words whose original initial letter was a consonant. There is no evidence that the Etruscans did the same. The Cippus evidently belongs to a period when Etruria, although maintaining its ancient constitution, was in recognized subjection to Rome.

[114] Lines 13-16. *bemi oyeche no:* the present Basque words for subject are *mendeko*, *botoya*. This *bemi* is a compound of *be*, under, and *imi*, to place, meaning the same as *subjectus*. In Basque *oyechek* is "even these," and *oyechen* "of even these." The Etruscan genitive is marked by the stronger *no*.

Ralapika rano, towards Ralapika. This is the name of the Lucumo, probably a native of Perusia, in whose honour the Cippus was erected. Etruscan proper names, like the Basque and American Khitan, seem to be significant. I leave the determination of their meaning to Basque scholars. The name may read Aralbeka.

bane gomu ekarri; bane is the abbreviated form of *banetu*, answering to the Basque *batu*. The Etruscan *gamu* represents the *gomu* of the Basque *gomuta*, remembrance. Compare Etruscan *gago* and Basque *gogo*. The verb *ekarri* is used participially.

eramira aginza mai ekarri: the only word to note is *eramira*, which is not modern Basque. It is, however, regularly formed by prefixing the causative *era*, as in *eraman*, *erakarri*, to the verb *mira*, *miratu*. *Ralapika* is in the genitive of position to *ambat begai*.

[115] Lines 17–20. *ambat begai:* Basque lexicographers suppose *ain* to be the root of *ambat*. It is more probable that *ain* is a corruption of an original *am*, for the Basque is hardly tolerant of the letter *m*, save at the beginning of a word. In Japanese *omoi*, meaning weighty, important, great, seems to present the same root. As *ambe*, the Etruscan uses the word to represent

21. CELA‡I.I.V.LE [116]
chinegora ich ugo begone
chingar etsaigo beko ne
spark enmity of prince to

Front of Cippus.

1. EVLNY · YA · NNA · LAPE‡LV [117]
nepisakaku kura kakara saratu ne ichsa be
ni Pisa gogo gure kakara zarratu ne itsas be
I Pisa's mind desiring states writing to adhesion under

---

the adjective great. Here, as in Basque, *ambat* seems to mean "so much, how much." The following *begai* is Etruscan, not Basque, which has the verbs *begiratu* and *begistatu*, meaning to regard. It is evidently a noun, signifying regard, esteem.

nayago etsain a obe ekarri zigor: nayago is a comparative of *nai*, meaning "rather desire," or "prefer"; the pronoun *ne* is omitted, perhaps because the word in Etruscan begins with *ne*. The verbal adjective *etsainta* I do not know in Basque, but *etsain-tasun* is the noun "enmity." It is spelt in this place as in lines 9–12, ‡E. The noun *obe* means literally "better," and in its use answers to the Greek *aristeus* and Latin *optimas*. In the Eugubine Tables it frequently replaces *jabe*. The verb *ekarri* is in the infinitive to *nayago*, which also governs *obe*. The last word, *zigor*, was probably *zigo-a* in Etruscan.

mai asma begogo: asma, signification, governs *mai* in the genitive by position. This genitive of position is not uncommon in Japanese, and is the usual form in Choctaw and many other Khitan languages. The verb *begogo*, Etruscan *begago*, is not Basque. It seems to be a compound of *gogo*, the mind, rather than of *begi*, the eye, and to mean considering. It answers in signification to the Basque *behatu*, the *be* of which is doubtless the *be* of *begogo*.

Pisa emaitza, in Etruscan *emats:* Pisa is governed in the genitive by *emaitza*, which is governed in the same way by the following, *uko*, refusal, denial.

ezarri; thus I read CA, which characters often stand for *zeru*, heaven, and for an Etruscan word, the nearest to which in signification is the Basque *jarri*. Here the sense calls for a verb meaning to place or throw, both of which significations are included in *ezarri*. It is here conjugated without regular auxiliary, and following the analogy of *ekarri*, should be *ezar*.

[116] Line 21. *chingar etsai go beko ne: chingar*, in Etruscan perhaps *chinegora*, means, a spark. The initial *chi* may represent *su*, fire, which appears in the Lesghian dialects as *zi*, *za*, *zo*. The Japanese word for fire is *hi*, and *hinoko* is a spark. But the same language preserves *su* as a word for fire in *subitsu*, the hearth, *sumi*, charcoal. The noun *etsai* now means an enemy, and *etsaigo*, enmity. There is no doubt, however, that the word should be read *etsai go*, of enmity, because its regimen *chingar* precedes it, and thus demands the postposition.

The word *beko* followed by the postposition *ne*, to or in, is not Basque. It appears in a Celtiberian inscription in the form *Roma beka*, replacing *Roma jabe*. It must, therefore, be an Etruscan and ancient Basque word for prince, connecting with the present *bekoki*, which Van Eys renders "front, audace." It is the same word as the Japanese and Choctaw *miko*, a prince, chief or governor. Immediately above it in the Choctaw dictionary appears *mika* or *bika*, both answering to the Basque *biga* or *miga*, two.

[117] Cippus of Perusia. Front, line 1. This line is defaced in the part of the first group which I have restored as LN, and in the end of the last group where I read LV.

ni Pisa gogo gure. The *ni*, I, is at once the subject of the participial *gure* and the verb *agerrikatu* in the second line. *Pisa* is in the genitive of position to *gogo*. The word *gure* is used as a participle, desiring, and governs *erimini* in the next line in the infinitive.

kakara, the states, without sign of plurality, has been referred to in lines 1-4, left side. It is in the genitive of position to *zarratu*.

zarratu ne itsas be: zarratu is employed as a noun in the dative to *ne*. In Basque *itsaskor*, from *ich*, means adhering. In this place *itsas* is used as a noun and is governed by *be*, under, the whole signifying "under adhesion."

2. AMEFALDLAVYN · FELOINAM · E[118]
eramine ager gotu sarabe kuka aginsa maukarano ne
erimini agerri katu zarrapo egoki aginza mai ekarri no ni-
cause to place declare writing suitable offering tablet bringing of I

3. MYLAA8VNAMSLELELEOCAFV[119]
nokusararalapikaranonosanesanesanemachiratupi
-on ikusi ra Ralapika rano nas antsa antsa ne ema jar tobe
him did see cause Ralapika towards together caring care to giving
attention instead of

4. YE‡AN8VMLEPIYESNMYEIM[120]
kuneichrakalabenosanetuukunenokanokuneuno
gune itcherik albo nas nituo gune noku naga ne on
us to adhering side together I to them do us to failing hates who good

---

[118] Line 2. *erimini agerrikatu zarrapo egoki.* The verb *erimini* is not Basque, but it is regularly compounded of the causative *era* and *imini*. It is in the infinitive to *gure*. The following *agerrikatu* should perhaps be *igorri-katu*, send, which will remove the syntactical difficulty of leaving *zarrapo egoki* without a governing word. Neither *agerri-katu* nor *igorri-katu* are Basque words, but *katu* is a common termination of Basque verbs, as in *igeri-katu*, to swim. Etruscan *zarabe*, Basque *zarrapo*, scratching, writing, is used as a synonym of *zarratu*. The Choctaw verbs to scratch are *shuluffih*, *kaluffih*. YN is always the Etruscan form for *egoki*.

aginza mai ekarri no, has appeared so frequently as to need no further explanation. The final *ni* belongs to the next line.

[119] Line 3. *nion ikusi ra ; nion* is good Basque, "I it to him did." The following *ikusi ra* is an inversion of *erakusi*, cause to see, instruct. I know of no corresponding Basque form of *ikusi*, but *ikasi*, to learn, becomes causative not only as *erakasi*, but also as *ikasarazi*.

Ralapika rano, needs no further explanation.

nas antza antza ne ; nas, Etruscan *nosa*, *nasa*, is still employed in one Basque dialect to mean together. It is evidently a compound word, as the Japanese represents it by *issho-ni*. The following *antza* repeated superlatively I cannot explain. The usual form of *antsi* to care for is EC, and here the word is plainly in the infinitive to *ne*.

ema jar tobe : here *jar* and *eman* come together as in the Basque word *jaramon*, faire cas de, faire attention. It seems to be used participially as "giving attention." The adverbial postposition *tobe*, instead of, has been considered.

[120] Line 4. *gune itcherik : gu* was the Etruscan pronoun, we, as it is the Basque, but in the dative it takes *ne* instead of *ri*. In some of the sepulchral inscriptions appears the long form *itchekirik*, from *itcheki*, to hold to, adhere. The final *rik*, of which *r* is for euphony, forms partitives and ablative absolutes. Here it seems to form a verbal adjective, adhering.

albo nas nituo ; albonas is in this place used as a compound verb with the auxiliary. The Etruscan had a pronominal form of *dut* in *nio*, answering to the Basque *diot*, as well as one in *nau* agreeing with the Basque *nau*. This *nio*, I to him do, is here in the plural of the regimen, *nituo*, I to them do, which answers to *nio* as *naute* does to *nau*.

gune noku naga ne ; gune is the pronoun "we" in the dative. The following *noku* has for its subject the *ne*, who, following *naga*. It survives in Basque as the noun *noku*, defect, and seems the same as the Japanese *nai*, *naku*, which with the auxiliary *naru*, means, to fail. In Etruscan it was *noka* and took rank as a verb. Here it should be in the 3 sing. pres. ind. without auxiliary. Its neighbour *naga*, in Etruscan *noku*, means, as has already appeared, to hate or oppose. It also is in the 3 sing. pres. ind. without auxiliary. The final *on*, in Etruscan *ono*, the adjective "good" belongs to the next line.

5. PAMNEMI/ΛAAMABENNA/ΛEp [121]
turano kaneno ubararamira ulne kakara banetu
Turano ganaino obi ra eramira Alin kakara banetu
Tyrrhenia towards grave to cause to see Dominion states united

6. XII · FELOINAOVPAMAPAM/ΛE [122]
xii aginsa mau karamapi turano ratura no bane
12 aginza mai ekarri ambe Turano ardura no bane-
12 offering tablet to bring great Tyrrhenia care of uni-

7. DAMCEMVLMLESCVL‡VCIEN [123]
turano chine mipisa misane nochipisa ichpi chi oneka
-tu ra aintzin imi Pisa imi ezan nauche Pisa ichpichio ne ki
-on to warning places Pisa place refuse he myself does Pisa contribution I

---

[121] Line 5. *Turano ganaino*: the Greco-Latin form Tyrrheni, and the Umbrian form Tarsin-ater indicate that the Etruscan word was Turaan rather than Turano. It is very probable that the word is the same as that Turan which has given a designation to the greater part of the human race, the Turanians. In his history of the reign of Feridun, Mirkhond, the Persian historian, sets forth Turan as embracing Chin, Machin and all the lands of Turkestan, that is, the countries north and north-east of Persia. Sadik Isfahani, in a geographical treatise, says that Turan extends from the Oxus to the extremity of the east, and northwards to the regions of darkness. The name Turan did not designate any one people, but was applied generically to many allied tribes or nations. The same word is probably found in *druna*, a gloss of Hesychius, who makes it equivalent to the Greek *arche*. Mr. John Fraser, in his "An Etrusci Celtae?" appropriately compares this word with the Tyrrhenian name and with the Greek *turannos*. The latter word has been derived from *koiranos*, but it is very probable that the Greeks picked it up in Asia Minor from the Hittite aborigines. The derivation of *druna* I have already suggested as being from the Basque *iturri*, source, fountain head. The Etruscans were the western Turan. The compound postposition *ganaino*, in Etruscan *ganeno* or *ganean*, now means as far as, but in Etruscan seems to have meant simply towards.

obi ra eramira: obi has appeared already (Left Side, 1-4), and *ra* needs no explanation. For *eramira* see Left Side, 13-16.

Alin kakara banetu XII., the 12 united states of the Dominion. The modern word for power, dominion, is *almen*, and this I have found in a Celtiberian inscription. In Etruria *alin* takes its place. Then follow the lost *kakara*, state or states, and *banetu*, united, the equivalent of the Basque *batu*. These 12 united states constituted *ono Turaan*, good Tyrrhenia.

[122] Line 6. *ambe Turano ardura no: ambe* means great in Etruscan. See note on *ambat*, Left Side, 17-20. Turano is governed in the genitive of position by *ardura*, a Basque word meaning care, which is itself governed by the postposition *no*, of.

bane belongs to the following line.

[123] Line 7. *banetu ra aintzin imi Pisa: banetu* is employed in this place as a noun, the union, and is governed by *ra*, to, towards. Also *aintzin* is a noun which means warning. But its composition with *imi* is precisely that of the Japanese to which I have referred in notes on Left Side, 5-8. Pisa was not one of the twelve states: Pignotti, Storia di Toscana, T. 1, p. 12.

ezan nauche Pisa; ezan, now *ez, eza*, is here a verb conjugated with *dut*. The compound auxiliary *nau* is the Basque "he me does." The final *che*, self, qualifies the *ni*, and serves to denote the double action of Pisa: "it warns the union and refuses myself."

ichpichio nekian nochiu. See Left Side, 9-12.

8. ESCIE⅄LYVLAPV[124]
nenochiu neb asakupisaratube
-an nochiu nabusi jabe sari tobe
did request master lord rewarding instead of

9. AVLEMI · FELOINAMAP‡NALCL[125]
rapisanenou aginsamai karano artu ichkarasachisa
arrapatzen nau aginza mai ekarri no artu itchekiri so chitsu
accuse me he does offering table bringing of to receive adherents
regard precedence.

10. ENMI · OII · OILMCVNA · CENV · E[126]
nekanou mata mausanochipikara chinekabe ne
neke nau emat mai asantsipikor zein gabe na-
fail he me does to give tablet to erect contribution which without

11. ⅄LC · 8ELICLAPOALMA8VNEM[127]
basachi lanesauchisaratumarasanoralapikaneno
-busitze lanesa hitzzarratu mara asan Ralapika nen
command workman word to write monument erected Ralapika to

---

[124] Line 8. *nabusi jabe sari tobe: nabusi*, in Etruscan *nebusa*, is an old Khitan word for master. It occurs in the long Phrygian inscription in Texier's "Asie Mineure," T. II., p. 157, the first group in which is not Kelokes, as it has been read, but *utzi nabusi utzi nion*, "lost master, I have lost him." It appears also in the Hittite inscriptions, Hamath I., II., IV. in the group I incorrectly read *ta basanesa sara*, which should be *nabusinesa zari*. Another Basque form of *nabusi* is *nausi*, answering to the Japanese *nushi*, master. The conjunction "and" is omitted between *nabusi* and *jabe*, which present the Japanese order. The word *sari* is employed as a participle, meaning "honouring" rather than "rewarding." It now means reward, and *saristatu* is to reward. The adverbial postposition *tobe*, instead of, governs *sari*.

[125] Line 9. *arrapatzen nau*, in Etruscan probably *arpetzen: arrapatzen* means literally to seize, but here signifies to accuse. A somewhat analogous case is *iratcheki*, meaning "attacher, joindre," but which in *iratchekitzen nau* signifies "il m'en veut."

artu itchekiri so chitsu: the verb *artu*, to take, receive, is one of the commonest occurrence in the Eugubine Tables. With *itchekiri* compare the attributive *itcherik* in line 4. The Etruscan equivalent for the Basque *gile, ille, gille* is *sa*, as in *lanesa*, workman, *zekesa*, niggard. This leads me to ask if the word in this group be not *itchekirisa*, he who adheres, an adherent, that is, to the confederacy, rather than *itchekiri so*, the regard of the adherents? The final *chitsu* I read as precedence, from *chitcea*, précéder, a word of Lecluse.

[126] Line 10. *neke nau*, he fails me; *neke* is not the same word as *noku* in line 4, although they agree in signification. It is the Basque *neke*, travail, peine, *nekezi*, disette, *nekatu*, se fatiguer, the original meaning of which seems to have been privation, failure.

emat; the form OII appears in the Eugubine Table I. a, lines 21, 25, and elsewhere, but with auxiliaries. Here it is an infinitive, governed by the preceding verb.

mai asantsi pikor, in Etruscan *pikara: asantsi* I find in Lecluse as *asantatcea*, maçonner, *asantua*, mur, muraille. The *as* must be *aitz*, a rock, used instead of *harri*, stone. This *aitz* is the Japanese *ishi*, a stone. In *pikor* or *pikara* we have a synonym of *ichpi*.

zein gabe, without which, namely, the *pikor* or contribution.

ne belongs to next line.

[127] Line 11. *nabusitze:* the pronoun *ni* is wanting, probably because *nabusitze*, really *nebusatze*, begins with E. As Lecluse says (p. 103): "Tout mot basque, nom, pronom, substantif,

12. CLENOVNꓶVLOE [128]
chisanekamabe kago pisamane
zazu neke ambe gogo Pisa eman
have you inability great mind Pisa to give

13. 8ALAM · ꓶIEM8VMLE · FELOINA [129]
larasarano gounemialpenosane aginsamaukara
lurrez rano goye ni imi albo nas ne aginza mai ekarri
grave towards word I place side together to offering tablet to bring

14. BINOACALEMVNICLEYMASV [130]
ulukamaerchirasanemipi kauchisanekumiranobe
al auka ema eritsi ra esan imbe kio zazu naiku mira nabe
Lucumo honour to saying send he does have you desire admiration to extend

---

adjectif, particule quelconque, peut se convertir en verbe en ajoutant *tcea* on *cea*, selonque le mot est terminé par une voyelle on par une consonne ; exemples :

bai, oui — *baitcea*, affirmer
aita, père — *aitatcea*, devenir père

Thus *nabusi* makes *nabusitcea;* but the final *a*, representing the article, has no place in Etruscan. It is better to adhere to one mode of orthography ; therefore I take the *itz* of Van Eys rather than the *itce* of Lecluse.

lanesa, now *langille:* see note on line 9 for *sa* as the Etruscan termination denoting an agent.

hitz zarratu mara asin Ralapika nen: hitz, word, is governed by *zarratu* which is in the infinitive to *nabusitze*. The common sepulchral *marakara, maragogo* is reduced to *mara*, a monument. In *asan* I find an abbreviation of *asantsi* in line 10. The postposition should follow *mara*, but is carried to the end of the clause and follows *Ralapika*. This postposition *neno* in Etruscan seems like a combination of *ne* to, and *no*, of. It answers to the *naino* of *ganaino*. In the Eugubine Tables it is found after names of places as in *arten banion Arretiag neno*, and thus appears to mean "into."

[128] Line 12. *zazu neke ambe gogo Pisa eman: zazu*, in Etruscan *zezu*, 2 pl. imperat. of *dut*. With *neke* it may read "fail ye," or "have ye inability." The only point of grammar to note is the absence of the postposition *ne* after Pisa. This detached passage, perhaps a quotation, seems metrical, a dissyllabic hexameter, so that poetic license may account for the missing *ne*.

[129] Line 13. *lurrez rano: lur* still makes *lurrezko* as well as *lurreko*, of the earth, terrestrial ; but here *lurrez* is employed as a synonym of *obi*, the grave.

goye ni imi; goye in Lecluse is conversation. In Japanese it is *kojo*, a verbal message. The following *ni* is the pronoun I, which accompanies the verb *imini*, to place, in an Etruscan form identical with the root, but which may, by a trifling change of the second vowel, have represented the 1 sing. pres. ind. without auxiliary.

albo nas ne: albo nas, see line 4 ; *ne* is the postposition *to* used as infinitive sign.

[130] Line 14. *Alauka ema :* the translation is literally "power choice given," probably meaning "the elected potentate." In Basque, choice is *auta* or *aukera:* in Etruscan it seems to have been *auka*. This is the *Lucumo* of the Roman writers. The groups which I read *alkamane* in the Hittite Inscriptions, Hamath I. II. and which I translated "I the powerful," may represent this ancient title of authority. The Lucumo is Ralapika.

eritsi ra ; infinitive.

esan imbe kio; esan is the present participle, which is really the radical part of the Basque verb. See Max Müller, Science of Language, 2nd Series, Lecture I.; also Lecluse, Manuel de la Langue Basque, p. 63, for the analogy of the English "I am saying, I do say" with the

15. NA⅄EPMPANC‡LOII8ALMYI · F [131]
karabanetu noturaka chiichsamatalarasanokuu ag
ekarri banetu ondoreak chiotssa emat lurreznokoi ag-
to bring uniting descendants let them to him give tumulus

16. ELOINABVY · NA⅄EP · ⅄ENE‡M [132]
nesamaukaraulpiku karabanetu banekaneichno
-inza mai ekarri al beko ekarri banetu bane kian etsain
offering tablet to bring powerful lords to bring uniting to join he did
oppose

Basque use of auxiliaries. Celts who speak English imperfectly frequently employ the present participle with the verb substantive instead of the direct present. The verb *imbe* is not Basque, but in Etruscan regularly takes the place of *bialdu* and *irion*. It occurs very often in the Eugubine Tables, and in every case satisfies the sense in this signification. If it be allowable at this stage to suggest etymologies, I would be disposed to see in *imbe* a compound of *imi, imini*, to place, and *bide*, a way. In Choctaw *pi* as a radical denotes a way, as in *pimma*, that way, *pillah*, away yonder. The same language renders the Basque *ibilli*, march by *bai-ullih*, of which the latter part is the verb *ulah*, to come. The Basque *ibilli* may by analogy be regarded as a compound of *el, eldu*, to come, and a primitive *ib, bi, be*, the root of *bide*, a way.

The final *kio*, in Etruscan *kau*, is the 3 sing. pres. ind. sign of verbs conjugated without auxiliary.

zazu naiku mira nabe: for *zazu*, see line 12. EY, *neku, negu* is the commonest form of *nai, nahi*, in Etruscan; it agrees with *zazu*. Of the two following words one must be a noun and the other a verb, but their simple forms do not indicate which is one and which the other. In Basque *mira* means astonishment; but it should rather be admiration. The word *nabe* means a plain in Basque, and *nabari* means to perceive from afar. In Japanese *nobe* and *nobara* designate a plain or moor, but *nobe, noberu, nobashi* mean to extend, stretch, lengthen, reach out. In this passage *nabe* may mean to extend, or *mira nabe* may be a compound word denoting wide or extensive admiration. The chief objection to the latter reading is that it places the adjective after the noun.

[131] Line 15. *ekarri banetu*, uniting to bring.

ondoreak: it is rare to find M and S representing initial *on, un*, which generally require a prefixed I as in IS *ono*, good. In a Celtiberian inscription, however, I have found MP for *ondo*. This *ondo*, though perhaps modelled upon the Spanish *hondo*, deep, is a genuine Basque word. In Japanese it is inverted as *ato-ni*, with the significations after, behind, posterity, descendants, remains, ruins. This Japanese *ato-ni* is to *ondo* as *issho-ni* is to *nas*. The Circassian *yeytahney*, after, agrees with the Japanese *ato-ni*. It is most improbable that a loan word should have so many compounds as *ondo* has in Basque.

chiotssa emat: I do not know *chiotssa*, or more correctly *chiichsa*, as a Basque pronominal auxiliary. He them to him does, is *diotza;* they it to him do, is *cioten;* and let them do, is *bezate*. I suppose *chiichsa, cietssa, cietsza*, to be a compound imperative, "let them to him do." For *emat*, see line 10.

lurreznokoi: lurrenokoi and *maranokoi* have appeared in the short inscriptions. I have queried *koi* as answering to the Japanese *koya*, a small house or chamber. Thus *lurre* has virtually two genitive signs like the Basque *lurrezko*. An earthen chamber must be a tumulus, the common mark of honour to the dead among the Khitan, as seen in the Pictish barrows of Britain, and the mounds of Siberia and North America.

[132] Line 16. *aginza mai ekarri al beko: al* is probably here used as an adjective, powerful, rather than as a noun denoting the Dominion in the genitive to *beko*. For *beko*, see notes on Left Side of Cippus, line 21. It must be in the plural without sign.

ekarri banetu, uniting to bring.

17. MASV · ACNINA · CLEL · A8VNAFEL[133]
miranobe rachikaukara chisanesa ralapikara aginsa
mira nabe eritsi kio ekarri zazu antsa Ralapika ra aginza
admiration to extend opinion he does bring have you care Ralapika to offering

18. OINAMLEP‡INA · INYEMAME[134]
maukaranosanetuichukara ukakunemiramine
mai ekarri no izanda etsai ekarri uka gune mira imini
tablet bringing of perhaps enmity it brings refuse us to consideration to place

19. P · CNL · FEL'OINA · ‡IANAYENE[135]
tu chikasa aginsamaukara ichurakaragunekane
du zekesa aginza mai ekarri etsai erakarri gune kian
he does niggard offering tablet to bring enmity cause to bring us to he did

20. YESNE · ESA · FELOIANOVDAMO[136]
kunenokane neuora aginsamaurakamapituranoma
gune noku ne ni narri aginza mai rako ambe Turano ema
us to fails who me incites offering tablet towards great Tyrrhenia gift

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bane kian etsain : bane for *banetu*, to join; *kian*, 3 sing. imp. ind. of verbs conjugated regularly, united with *etsain*. I cannot account for the difference of form in *etsain*, here ‡M, and on Left Side 9-12, 17-20 ‡E. Judging by the context they are the same words.

[133] Line 17. *mira nabe :* see line 14.

eritsi kio ekarri : eritsi or *eritzi* is here, as in Basque, a noun signifying, opinion; *kio ekarri*, he brings.

zazu antsa : for *zazu*, see line 12. Here again is *antsa* instead of *ansi*, care.

Ralapika ra aginza mai ekarri no, of bringing a tablet of offering to Ralapika.

[134] Line 18. *izanda etsai ekarri* or *akar : izandaite* (Lecluse), perhaps. For *etsai*, see Left Side, line 21. The defective Etruscan syllabary marks no distinction between the participle *ekarri* and the 3 sing. pres. ind. *akar*, now *dakar*.

uka gune mira imini du : uka is the verbal form, now *ukha*, *ukatu*. The substantive form is *uko*, Left Side 17-20. The auxiliary of *uka* is at the end of the sentence, *du*, he does. The pronoun *gu* is in the dative, to us. In this case *mira* is a noun, regard, consideration. The verb *imini* is in the Etruscan infinitive; otherwise *imi* would suffice.

[135] Line 19. *zekesa* is formed from *zeken*, *cheken*, stingy, penurious, by replacing the final *n* with the Etruscan mark of agency *sa*. See *lanesa*, line 11. It is here vocative.

etsai erakarri gune kian : erakarri, cause to bring, *kian*, he did, *gune*, to us. Perhaps Pisa persuaded some of the minor powers to refuse contributions.

[136] Line 20. *gune noku ne*, to us who fails.

ni narri : the Etruscan has the same form of the pronoun E, *ni* or *ne* for the nominative and accusative, but oblique cases change it to S, *no*. The verb *narri* is now *narritatu*, incite, annoy.

aginza mai rako : rako, in Etruscan *raka*, is a synonym of *rano*.

ambe Turaan ema : ema for *emasa*, in Basque *emaitsa*.

21. AVPABELVYESNEDAMNECEI [137]
rapitura uinesapikunenokaneturanokanechineu
arrapatura Alin azpi gune noku ne Turano kian eznai
accept to Dominion under us to fails who Tyrrhenia he did despise

22. YESNMYEIMDAMNEMLIMOM/A [138]
kunenokanokuneunoturanokanenogoumimonoba
gune noku naga ne on Turano ganaino goye imi ema no ba-
us to fails hates who good Tyrrhenia towards word place giving of

23. ELOVYAMCVNAASVNAMENA [139]
nesamabekuranochipikararalapikaraminekara
-nais ambe gure aintzi pikor Ralapika ra min ekarri
I am very desirous to inform contributions Ralapika to grief bringing

24. BEN · NA/EP · CICNLBAPEVYVME [140]
ulneka karabanetu chiuchikasaulartunepikupinone
Alin ka ekarri banetu chehe zekesa ahal arten bu jabenen
Dominion by to bring uniting little niggard contempt receive does of
the lords

---

[137] Line 21. *arrapatu ra : arrapatu*, in Etruscan *arpetu*, *erpetu*, is often used as a synonym of *artu*, to hold, receive. The *ra* marks the infinitive to *narri*.

Alin azpi gune noku ne : Alin, the dominion, *azpi* under, *gune*, to us, *noku*, fails, *ne*, who.

Turaan kian eznai : there is a change of tense which I have elsewhere observed in Etruscan construction, but cannot account for. The preceding *noku* is in the present, while *kian* marks the past of *eznai*. As for *eznai*, literally, to wish not, it is not Basque so far as I know. An analogous form *ez-ezerten artu* means, to despise. The Japanese forms verbs of contempt and dislike with *iya*, the equivalent of *ez*, such as *iyagari*, *iyashime*. The Choctaw does the same with *ik*, *ikahninchoh*, *ikahobuloh*.

[138] Line 22. *gune noku naga ne on Turaan ganaino*: for this peculiar construction see line 4.

goye imi ema no : for *goye imi* see line 13 ; *ema no*, of giving.

[139] Line 23. *banaiz ambe gure aintzi :* for *banaiz* = *naiz*, see Left Side 1-4. The following *ambe*, great, is an adverb qualifying *gure*, very desirous. This *gure* governs the preceding clause, *goye imi ema no*, and on the *goye imi* depends *aintzi*, to warn or make known.

pikor Ralapika ra min ekarri ; for *pikor*, contribution, see line 10. The Basque *min*, Etruscan *mine*, means grief, pain, and desire. This must be read : "the contributions bringing (testifying) grief to Ralapika."

[140] Line 24. *Alin ka* : *ka* is the postposition, by. Thus it reads : "By the dominion, *ekarri banetu*, uniting to bring, *pikor*, &c., contributions."

chehe zekesa : for *zekesa*, see line 19. The preceding *chehe* means little, a synonym of *chipi*. In Etruscan *chipi* is used in a good sense, *chehe*, in a bad.

ahal is the same in form as *al*, *ahal*, power, but here, as in the Eugubine Tables sometimes it signifies shame, contempt, being the radical of the present *ahal-ge*.

arten bu jabenen : the verb *artu*, *artzen*, is here *arten*, the Etruscan equivalent of the latter. The accompanying auxiliary is Etruscan *be*, but I have represented it by *bu* as that 3 sing-imperative form is the only one in Basque which preserves the old synonym of *du*. The Etruscan has *beno* or *pino* for "he did," answering to the modified imperfect *banu* in Basque. The form of *banu* or *beno* in the present tense in Etruscan was *be*. *Jabenen*, in Etruscan *gubenone*, is the genitive plural.

CLOSE TRANSLATION OF THE CIPPUS OF PERUSIA.

Left Side.

For bringing a tablet of offering I requested the contributions of the accordant states, *saying:* I am causing a tablet to be made towards the grave, *and* on the side I am giving information, as to who chose to bring disesteem *to* the tablet of offering. Only (one) fails to honour. Instead he warned the lords to oppose to communicate the contributions I requested. Of these subjects of Rome bearing united memory towards Ralapika, bringing a tablet of offering causing to be seen *their* great regard for Ralapika, I desire the inimical lord to bear the scourge, considering the signification of the tablet. The refusal of the gift of Pisa throws the spark of enmity at the prince.

Front.

I, desiring to cause the mind of Pisa to be placed under adhesion to the writing of the States, declare *by* suitable writing *the intention* of bringing a tablet of offering. I instructed him (the ruler of Pisa) together caring (testifying regard) to care for Ralapika, giving attention *to this, that* instead of *them* adhering to us I take part together with them. He who fails us shows enmity towards good Tyrrhenia, causing to be seen towards the grave the twelve united states of the Dominion.

Pisa gives warning to the Union of the care of great Tyrrhenia to bring a tablet of offering. To myself Pisa refuses the contribution I requested instead of honouring *his* master *and* lord. He accuses me of bringing the tablet of offering *in order* to gain the precedence of the adherents. He fails to give me a contribution to erect the tablet, without which I command the workman to write the word *on* the monument erected to Ralapika:

"BE YE UNABLE TO GIVE A GREAT SOUL TO PISA."

I give word to take part together to bring a tablet of offering towards the grave to honour the Lucumo. He sends, saying: "Do you have the desire unitedly to bring an extensive spectacle, *but* let *his* descendants give him a tumulus." He opposed joining the powerful princes uniting to bring a tablet of offering to extend admiration. He brings *his* opinion: "Do you have a care of bringing a tablet of offering; perhaps it brings enmity." He refuses to pay us consideration, the niggard! Bringing a tablet of offering he caused enmity to be brought to us. He who fails us incites me to accept the gift of great Tyrrhenia towards the tablet of offering. He who under the Dominion fails us despised great Tyrrhenia. He who fails us shows enmity towards good Tyrrhenia.

I am very desirous of giving *command* to place a word setting forth the contributions bringing (testifying) grief towards Ralapika. By the Dominion uniting to bring *these*, the little niggard receives the contempt of the lords.

The following inscription is found in Lanzi, Vol. II., p. 438, No. xxiii., but is given with the emendations of Fabretti. It was

found in a tomb about two miles from Perusia, although the subject of the epitaph was a native of Sena :

TOMB OF SARAPIKUKA.

1. FEBEN · SVOI · BINOIV · OVEM · SIANM · EVFE · OAVDE [141]
agin ulneka nobemau ulukamaube mapineno nourakano nekuegin marapitune
agin Alinka nabe mai Alaukama obe Ampineno nau rakone naiku egin mara epaten
offered Dominion by extended tablet Lucumo lord Ampineno he me does approach desiring to make monument to fix

2. LAVYNEMCLE · CADESDI · AVLEM · LAPIAL · ⅄DECVOVDAMI [142]
sarapikukane nochisane chiratunenotuu rapisaneno saratuurasa batunechipi mabeturanou
Sarapikuka ne aintzitzen jardun natiu arrapatzen no zarratu au eritza batu inyubi ambe Turanoi
Sarapikuka to to present pay attention they me do taking of writing this honours army beloved great Tyrrhenia to

---

[141] Tomb of Sarapikuka.

Line 1. *agin Alin ka : agin* is the verb, to promise, command, offer, which forms *aginza*, offering. For *Alinka*, see Cippus of Perusia, Front, line 24.

nabe mai : *nabe* is here an adjective, extended, great.

Alaukama obe : for *Alaukama* see Cippus, Front, line 14 ; for *obe* see Cippus, Left Side, 17-20. The whole is equivalent to "the lord Lucumo," who is not in this case the subject of the inscription.

Ampineno or *Mabineno*, the name of the Lucumo.

nau rakono : the common pronominal auxiliary *nau* indicates that the postposition *rako* with the increment *no* has become a verb, meaning "he towards, or approaches me."

naiku egin : for *naiku* see Cippus, Front, line 14. FE may be *agin*, command, as well as *egin*, make.

mara epaten : for *mara* see Cippus, Front, line 11. The following VDE I read as the Basque *epaten*, fix a limit. If *mara* represent the modern *marra*, the two words will mean "to set a mark."

[142] Line 2. *Sarapikuka ne aintzitzen : Sarapikuka*, the name of the deceased general, in the dative to *ne*. The verb *ainzindu*, to go before, seems in Etruscan to have assumed an infinitive form *aintzitzen*, meaning to present, combining *praesum* and *praesento*.

jardun natiu : the common Etruscan verb CA, *chira, zira*, more fully CADE, *chiratune, zira-tune*, I have already referred to several times. It means "to pay attention to," and thus connects with the modern *jar*, attention. I am not aware that *jardun*, which generally means "to be occupied," ever conveys such a notion, yet as corresponding in form I have taken it to represent *chiratune*, which stands in this place for "compliment, do honor."

The auxiliary is the plural of *nau* in Etruscan, which in Basque is *naute*. As in Basque *nuen* makes in the plural *nituen*, so in Etruscan *nau* made *natiu*.

arrapatzen no : in Etruscan *erpetzen no*, of taking.

zarratu au eritza : the construction is not clear. One would expect the infinitive *eritzi* rather than the indicative *eritza*. The demonstrative *au, hau*, this, must stand for the personal pronoun.

batuinyubi : in the Eugubine Tables *batu* is one of the commonest words and unmistakably denotes "an army." It is not found in Basque, but *pampots*, brave, *farfatzea*, strike, *bota*,

3. LADOIALISFLE · CESYNAL · CLENAPAMI · EO · 8ANV · LAVYN[143]
saratumaurasauno-agsane chinenokukarasa chisanekara turanou nema larakabe sarapikuka
zarratu mai eritza on agisa ne Senanako sortze etsitzen ekarri Turanoi ni ema *lara*gabe Sarapikuka
written tablet honours good commander which Sena born honour to bring Tyrrhenia to I give (permission) Sarapikuka

4. ΛPECVM · I/ΛA · MVP‡VA · CEDVDVM · EIN · BEC‡DI[144]
batunechipino ubara mipituichpi ra chinetupitupimi neuka ulnechiichtuu
batu inyubi no obi ra *imbetu* ichpi ra Sena *tobe tobe* imi nayago Alin che itsatui
army beloved of grave to send contributions to Sena instead instead to place I desire Dominion even adhering to

5. YVNVP · CLVYFA · ‡ELVP * * * * p[145]
kupigabetu chisapiku ager ichensapitu * * * * tu
jabe 8abetu etsitzbeko agerri——— ———
lord deprived appreciative regard to manifest———

---

butatu and *abaztorra*, drive away, repulse, seem to preserve the root *bat*. The corresponding Japanese word is *butsu*, to strike, whence comes *bushi*, a soldier.

The following word in Etruscan is *nechipi* or *inchibi*. It may answer to the Basque *nehabe*, a servant, or be a compound of *ansi*, as *ans ibe*, one who cares for, or represent *inyubi*, great desire. For the present I translate it as the beloved or darling of the army.

ambe Turaani: for *Turaan*, see Cippus, Front, line 5. The word is here in the dative without postposition to *arrapatzen*.

[143] Line 3. *zarratu mai eritza on agisa ne:* *eritza* is in 3 sing. pres. ind. agreeing with the relative *ne* at the end of the clause, its antecedent being *zarratu mai*. The Etruscan *agisa*, formed from *agin* as *lanesa* from *landu* and *zekesa* from *zeken*, is a synonym of the commoner *agintzari*, a commander.

Senanako sortze: Sena takes an additional *n* before the genitive *ko;* compare *Bayonako*, of Bayonne.

etsitzen ekarri Turaani: this presents what in Etruscan is an unusual form of *etsi*. It is Basque however. Turaani is dative as in line 2.

ni ema, I give.

laragabe is an enigma. It seems to be a negative expression composed of *gabe*, without, having the positive meaning, permission. In Basque permission is *baimen* or *zilhegi*. In the Eugubine Tables *menimi* represents *baimen*. Perhaps *laragabe* is literally "without opposition," but I do not know with what Basque word to connect *lara*.

[144] Line 4. *obi ra imbetu ichpi ra:* for *obi*, see Cippus, Left Side 1-4, and for *imbe*, Cippus, Front, line 14. This is the first appearance of the full form *imbetu*, which with *ichpi*, contribution, constitutes a compound verb, with *ra* as the sign of the infinitive.

Sena tobe tobe imi: for *tobe*, see Cippus, Left Side 9-12. The first *tobe* qualifies Sena; the second apparently forms a compound verb with *imi*.

nayago: see Cippus, Left Side 17-20. It has comparative power: "I prefer."

Alin che itsatui: the *che* means "even." The noun *itsatu*, here in the dative, shows the root *itsat* of *itsatsi*, *atzitu*, hold, seize, but which in *itsaskor* means, adhere. Thus *itsatui* will mean, "to the adherents."

[145] Line 5. *jabe gabetu: gabetu* means deprived. Here it should signify departed. The Basque uses *zen* for late, defunct, answering to the Iroquois *kenha*. The Japanese *shini*, death, agrees.

CLOSE TRANSLATION OF THE INSCRIPTION ON THE TOMB OF SARAPIKUKA.

An extensive tablet offered by the Dominion the Lord Lucumo Ampineno approaches me desiring to make, to set up a memorial to present to Sarapikuka. They do me the honour of taking to great Tyrrhenia the inscription *which* honours the beloved of the army. The written tablet which honours the good commander I willingly allow Tyrrhenia to bring to show regard to the native of Sena. Instead of Sena I prefer to grant to the adherents of the Dominion to send contributions to the grave of Sarapikuka, the beloved of the army, to manifest *their* appreciative regard of the departed lord.

The last inscription I present is that on the leaden tablet of Magliano, which has been variously read by Deecke, Bugge, and Pauli. The text is apparently corrupt, and many characters are confessedly uncertain. The meaning, however, is evident.

THE LEADEN TABLET OF MAGLIANO.

Front.

1. CAVOAS · YVOIV · AFILS · LXXX · E‡ · ⅃IMOM [146]
   chirapimarano kupimaube raagusano 80 neitch goumimami
   zeru pimo rano Kupima obe irago atsono 80 ni itch Goumimami
   heaven first towards Kupima lord passing age of 80 I thank Goumimami

2. CASOIALO · LACO · BEFN · AFIL · NENL · MAN [147]
   chiranomaurasama sarachima ulneagka raagusa kanekasa miraka
   jar no mai eritza ema —— alin egi ka irago atso kian — miraka
   attention of tablet honours to give —— authority exercising in pass age he
   did — seeing by

---

etsitz beko agerri: for *etsitz*, see line 3. I regard *etsitz* as an adjective, meaning appreciative, but only on the authority of analogy. VY *beko*, I suppose an abbreviation of VNY *begogo*, consideration, regard. Some such meaning seems to be required by the following *agerri*, to manifest.

[146] Leaden Tablet of Magliano: Front.

Line 1. *zeru pimo rano: zeru* Basque, heaven; Lesghian *ser, sur;* Japanese *sora;* Iroquois *karonhia*. The following *pimo* is the Etruscan one, here used as "first." *Kupima obe*, may be the lord of Kupima or lord Kupima, the living subject of the inscription.

irago atso no: the common formula for stating age, the *avil* of Etruscologists, which with *ril*, Niebuhr thought to be the only words satisfactorily translated. In Etruscan it is *irag* rather than *irago*. For *atso*, see remarks under Lanzi 46. The following *no* is the postposition of.

ni itch: ni is the pronoun, I. The verb *itch* only exists in Basque with the significations shut, leave, and as the root of *icheki*, hold. I suppose an old meaning, to thank, as the root of *es-ker*, thanks, gratitude. The Japanese has *sha-suru*, to thank.

Goumimami, the name of Kupima's colleague and successor, see lines 4, 5.

[147] Line 2. *jar no mai eritza ema.* Owing to the uncertainty and obscurity of the next group, I translate this one according to the analogy of the last group in line 4, the meaning of which is clear. It seems from it that *eritza* is an attributive or adjective form, unless it stands in the genitive of position to *mai*, when it will be a substantive.

3. MVPINAMIE · FALYAOI · AISEPAS · IN · ECS · MENE [148]
mipituukaranoune agersakuramau raunoneturano uka nechino minekane
———————— agerri askor mai irion ne Turano uka ni che no imini kian
———————— manifesting joy tablet send to Tyrrhenia refusing I self of place did

4. MLAOCEMAPNI · YVOI · YIV · ⅃IMOM · CAOIALOI [149]
misaramachinemiratukau Kupimau kuupi goumimami chiramaurasamau misa erama zein miratu kio Kupimai koi bu Goumimami jar mai eritza mai monument to bring which show does Kupima to desire has Goumimami attention tablet esteem tablet

5. AO · MAPIML · MENIYLA · AFPS · CI · ALAO · ⅃IMOM [150]
rama miratuunosa minekaukusara raagtuno chiu rasarama goumimami erama miratu au aintza men zahako zari irago du no sei urte erama Goumimami
to bring to show this predecessor power besides chief pass does until 6 years to bear Goumimami

---

alin egi ka, literally, by doing sovereignty, that is, in exercising authority.

irago atso kian kasa miraka: kian, he did, belongs to *irago*. The final *mira-ka* means "by beholding," but probably forms an idiom with the untranslated *kasa*, signifying "rarely seen."

[148] Line 3. *mipituukaranoune:* the first part of the group is plainly *imbe*, send, or it may be *imbetu*. If *imbe*, then *tuu* is *dio*, he to him does. The sentence is obscure owing to the uncertainty of the last characters and the blanks I have been compelled to leave in the preceding line.

agerri askor mai: here also Y is doubtful. Also I question the propriety of reading LYA, *askora* which now means, joyous, but can suggest no better reading.

iraun ne Turaan uka: iraun means to continue, preserve, extend. The true equivalent of AIS is probably *irion*, to send. The *uka* following *Turaan* is the verb, to refuse.

ni che no imini kian; I of myself did place. Here *imini* means decide.

[149] Line 4. *misa erama zein miratu kio: misa* is a new word, unknown in Basque, but connecting probably with *mira* like the Japanese *mise*, an exhibition. It is a common word in the Lycian inscriptions, constituting the first part of the words hitherto read *mete*, *mene*, and translating the Greek *mnema*. The verb *miratu* has here the meaning to show. *Kapimai* is in the dative.

koi bu: Etruscan *be*, as I have already sufficiently indicated, is the equivalent of Basque *du*. The preceding *koi* now means desirous, but here forms a verb with *be*=he desires.

jar mai eritza mai: tablet of attention, tablet of esteem. See line 2.

[150] Line 5. *erama*, in infinitive to *koi bu*.

miratu au aintza: the sense is not clear. I read *aintza* as predecessor, from *aintzindu*, precede. It may be a synonym of *eritza*. If it means predecessor, the dative sign is omitted.

men zahako zari: this also I give with hesitation. After *men*, power or authority, comes *kahako* and then *zari*, a chief. The Japanese *hoka* means other, besides, outside, answering perfectly to the Basque *zahako*, outre. I suppose therefore that this is the only way in which the Etruscan indicated a colleague, namely as "another lord of authority."

irago du no: the Etruscan had the auxiliary *du* as well as *be*, but I have not yet discovered any rule for their respective employment. The final *no* I regard as the postpositive until, (Lecluse, Manuel, 112).

6. AFILSL · ECA · CE⅄EN · YVOIV · OVL · ILVYEFP · BESNI [151]
raagusanogo nechira chinebaneka kupimaupi mapigo ugopikuneagit ulnenokau
irago atso nagi ni che ra zein bane ka Kupima obe mopigo ogoi bakan egit alin no kio
passes age idle myself to who joining by Kupima lord twice 20 alone exercise authority of does.

7. MVLFENI · EO · YVCI · AM · APS [152]
mipisa agin kau nema kupichiu rami artuno
imbesa agin kio ne ema jabetzio —— artu no
messenger command he does me to give to rule —— receiving of

Reverse.

1. MLAOAN · CALVSC · ECNIA · AFIL · MIMENICAC [153]
misaramaraka chiraspinochi nechikaura raagusa miuminekauchirachi misa erama rako jarritza banuche anzeko hiri irago atso imini kio jarritze
monument bringing towards request I did self like cities passing age little place he does attention.

---

chiu arsa erama, or in Basque *sei urte derama*, six years to bear. The subject is Kupima; the double object, Goumimami and *men zahako zari*, in apposition.

[151] Line 6. *irago atso nagi*: I read SL *nogo* as the Basque *nagi*, idle, but in the good sense of the Japanese *nagu*, Choctaw *nukchito*, calm, quiet. The verb must be in the 3 sing. pres. ind. without sign.

ni che ra zein baneka: *zein* is the subject of *irago*, the rest being an adverbial clause. One would expect to find Goumimami speaking of Kupima joining the younger man to himself in authority. On the contrary, he says: "who, by uniting to myself, passes a quiet *old* age." In *bane* we have the shorter form of *banetu*, Basque *batu*, followed by the postposition *ka*.

mopigo ogoi bakan egit alin no kio: *mopigo* is the Etruscan twice, from *mopi*, two. The final *go* answers the purpose of the Basque *etan*. In *bekune* we have already found the Etruscan equivalent of the Basque *bakar* and Japanese *bakari*. The verb *egin* becomes *egit* as in *egiten*, and finds its auxiliary at the end of the sentence. Also, differently from the *alin egi ka* of line 2, *alin* takes the postposition *no*, of.

[152] Line 7. *imbesa agin kio*: *imbesa* is formed like *lanesa* and *zekesa* of the Cippus. It means, a messenger, and is probably the original of the word embassy. Here the word may denote an officer of the Confederacy: see Reverse, line 3. There is no distinction in Etruscan between *egin* and *agin*, both of which are represented by FE. The context determines that the verb here is *agin*.

ni ema jabetzio rami artu no: instead of *ni* one would expect *no*, as *eman* governs the dative. The word *jabetzio* is a form of *jabetu*, to rule or command. It is in form like *ichpichio* of the Cippus. The following *rami* is an enigma. The same characters AM in the Eugubine Tables frequently give the Etruscan equivalent of the Basque *irrin*, division, showing that the Basque here as elsewhere has changed final *m* to *n*. The sense of the passage rather favours the idea that, having shared the authority for six years, Goumimami was now to rule alone. In one of the bilingual Lycian inscriptions I find *ramira*, translated by the Greek *panta*. This would connect it with *arrunt*, rather than with *irrin*. The Basque *arrunt* means commonly, but also "all without exception," and thus answers to the Japanese *aremashi*, in the main, generally. The verb *artu* is in the genitive to *ema*.

[153] Reverse:

Line 1. *misa erama rako*: for *misa*, see Front, line 4.

2. MAPCALVPCAC · EOYVOIVNESL · MAN · PIFAL[154]
miratuchirasapituchirachi nemakupimaupikanenosa miraka tuuagergo
miratu zeru kupida jarritze ni ema Kupima obe kian aintza mira ka dio agerri go
to show heaven compassion attention I give Kupima lord did present beholding by it him inform will

3. LECEM · YNVCASI · MVPISES · YEIS · EFIYVDAS · MVLSLE[155]
sanechinemi kukapichiranou nopituunoneno kuneuno neagukupiturano mipisanosane
zuen zein imi egoki ——— nabetu ona nioh gune ona ni age jabe Turano imbesa aintza ne
did who place suitable ——— extend goodness I him did to us goodness I inform Tyrrhenia messenger presents who

---

jarritza banu che: it is hard to say why we have *jarritza* rather than *jarritze*. *Banu che*, in Etruscan *beno che*, I myself did.

anzeko hiri: the city of Kupima and Goumimami is not mentioned. The root of *anzeko* is *anz* or *antz*, resemblance, connecting rather with the Japanese *nise-ru*, to make like, than with *onaji*, like.

mehe imini kio jarritze: mehe, little, slender, lean, probably the same as the Lesghian *mici*, *mitshi*, and Georgian *smia*, little. Here *jarritze* seems like *jar* to be a noun governed by *imini kio*.

[154] Line 2. *miratu zeru kupida jarritze: miratu* again means to show; see Front, line 4. Heaven, *zeru*, is personified; it is doubtful that the Etruscans had a deity of this name. Yet in Lanzi, Vol. II. Tav. VI., p. 6, an angel is called LASAFELV *sarunora agintzabe*. The latter word *agintzabe* should mean a servant or messenger. In the Eugubine Table syllabary C does not appear, so that L does duty for all powers of *s*. If it be so in the case of LASA, as seems probable from the rare appearance of C, we may read *zerunora*.

The word *kupida* may in Etruscan be read *supida*. The corresponding word in Japanese is *itawashii*. These three forms *kupida*, *supida*, *itawashii*, suggest as the Etruscan original *zupida*, inasmuch as *z* may easily, by laying stress on the dental element, become *t* as in Japanese, and the permutation of *z* and *k* is not uncommon in Basque. For *jarritze* see line 1.

ni ema kupima obe kian aintza: this is one of the numerous instances in which the Etruscan exhibits the entire independence of its various parts of speech. The pronoun *ni* is separated from the auxiliary *kian* by three words, and *aintza*, which means either a present, or precedence, and is the direct regimen of *ema*, follows it at a similar distance. I cannot account for the absence of the dative sign after *kupima obe*. It must be understood.

mira ka dio agerri go: the only words needing explanation are *dio* and *go*. The former is the Basque auxiliary with included pronouns "it him does," The Iroquois has the same complex system of included pronouns; e.g. *rak*, he me does, *tak*, thou me dost, *kon* I thee do. The Japanese entirely dispenses with such pronominal refinements. The final *go* is the sign of the future tense in Etruscan, as it still is in the Spanish Basque dialects. Another Basque future suffix is *en* answering to the Japanese *n*. The Iroquois future suffix is *en* or *ne*: that of Choctaw, *ching*.

[155] Line 3. *zuen zein imi*, literally, did who place. Here the Etruscan uses the common Basque 3 sing. past indic. of *dut*.

egoki pichiranou. This expression I cannot explain. YN in Etruscan as regularly denotes *egoki* as NY gives *gogo*.

nabetu ona nion: nion Basque, I him did; *nabetu*, extend, here seems to mean, publish widely. The inherent dative of *nion* combining with *ona*, goodness, to make "I to him the

4. MLAL · ILALE · YINS · LVPSO · YEF[156]
misarago usaragone kuukano sapitunoma kuneag
misa rako atso rakone goijaun kupida no ema gune ag-
monument towards age acknowledging high lord compassion of gives us to

5. AVFIOVN[157]
rapiagumapika
-erri Begiaumabeka
manifestation ——— ———

6. LVDSOSAL[158]
sapitunomanorasa
kupida no ema no eritza
compassion of giving me he honours

7. ESDS · NAC[159]
nelatuno karachi
ni lotu no ikheretsi
me joining of to show gratitude

---

goodness widely proclaimed," in English idiom gives the possessive, "I widely proclaimed his goodness."

gune ona, goodness to us, a case of anadiplosis.

ni age jabe Turano imbesa aintza ne. The verb *age*, root of *agerri*, in Etruscan means inform. I think *jabe* and *imbesa* are in apposition, the lord, the envoy of Tyrrhenia, that is the representative of the Confederacy or Dominion, appointed probably by the Lucumo. I read *aintza ne* as "who presents."

[156] Line 4. *misa rako*, towards the memorial.

atso rakone: the final *ne* seems to change the postposition *rako* into a verb. In the Eugubine Tables *rano-ne* is similarly employed, meaning to approach, join, yield to. recognize, be of the same party. Here *rakone* seems to signify acknowledging or paying respect to.

goi jaun: this inversion of *jaungoi* or *jaungoiko*, the name of divinity among the Basques, has already appeared in these pages in connection with votive inscriptions. It is in the genitive of position to the following:

kupida no ema: for *kupida*, see line 2. It is in the genitive governed by *no*. The verb *ema* has *ne* at the end of line 3 for its subject. It governs the following *agerri*.

gu ne agerri, to us declaration.

[157] Line 5. *begiaumabeka:* the first part is probably *begi*, eye. It may be the name of a god or an old form for Providence; *nescio*.

[158] Line 6. *kupida no ema:* see lines 4 and 2.

norasa, may be for *nau eritsi*, he honours me.

[159] Line 7. *ni lotu no:* the verb *lot*, *lotu*, *lotzen*, now means to bind. In Etruscan it had a more extended signification, being a synonym of *banetu* in the Eugubine Tables. The Choctaw *hollotti* means bound; but many words of similar form, like *hlitoha*, mean unbound.

ikheretsi or *ikherreste* in Basque means gratitude. In this place it seems a verbal form, namely *eritisi*, preceded by *ka*. As a noun the Basque *ikherreste* is a synonym of *esker*. The original signification of *etsi*, whence *onetsi*, *eritsi*, *ikerhetsi*, *gaitzetsi*, is given, I think, in the Choctaw, which has a verb *eshih*, *ishih*, *isht*, meaning to hold, receive, take. In Basque *artu* has superseded *etsi* in these original senses of the word, but in composition it may be detected

CLOSE TRANSLATION OF THE LEADEN TABLET OF MAGLIANO.

Front.

To Heaven first I, Goumimami, render thanks for Lord Kupima passing the age of 80. The tablet of regard to give honour ——— in the exercise of authority he passed an age *rarely* seen. ——— Tyrrhenia refusing to send a tablet expressing gratulation, I of myself resolved to bring a monument which shows *that* Goumimami has the desire to provide a tablet of regard, a tablet of honour to set forth his predecessor. Until he passes six years having Goumimami *as* colleague, by which union to myself he passes a quiet *old* age, the lord Kupima exercises authority alone forty *years*. He commands the envoy to give me *the power* of receiving *entire* authority.

Reverse.

I myself requested the coördinate cities *to help* towards bringing the memorial. Little does he care for attaining *so great* an age. To pay regard to the compassion of Heaven I gave Lord Kupima *this* offering. By beholding, it will inform him who placed a suitable ———. I published abroad his goodness, *his* goodness to us. I inform the lord, the envoy of Tyrrhenia, *that he* who presents towards the memorial, acknowledging the age, gives us an indication of the compassion of God. ——————— giving of the compassion, he honours me by joining me to show gratitude.

I conclude this paper with a transliteration of the groups of characters contained in the Augurial Templum of Piacenza to which allusion has been made on page 222. This I do in the hope that scholars possessing a better knowledge of Basque and of the subjects likely to be set forth in such a Templum than I possess may be able to shed light upon it. The Templum consists of a number of compartments indicated by a double series of numbers as follows:

1. ANI ONE rakau makane ? raka = argi, light.
2. VNI ΠAD pikau baratu pikoya burdax, end of the plough
3. YEO FΠ kunema agba See 13′ gune ema *agba*, place gives ——
4. LEON sanemaka See 9
5. EO nema
6. CAO chirama zeru ema

---

as the verbal termination—*tze-tzen*, just as *artu* appears in—*artze-artzen*. To gain the heart is in Basque *goga-tu*, *goga-tze*; in Choctaw it is *chukush-eshih*. Thus *on-etsi* originally meant to hold good, and *gaitz-etsi*, to hold bad, and *etsi* is but another form of *atchiki*, to hold. Also *er-itsi* may be derived from *arau*, rule, right, proportion, fitness, with the original signification to hold aright or fitly. It is only by careful and full comparison of words and constructions in the different Khitan languages that the radicals can be detected and a scientific system of etymology be made to take the place of conjecture.

7. 8V8LVSLNC alpilasapinosakachi; ilbeltz bena sokache ; ilbeltz = moon, January.
8. IFN uagka
9. LEONE sanemȧkane See 4, 17, 2′, 9′.
10. YLVSCF kusapinochiag ; eguzbena *chiag- ;* eguz = eguzki, the sun.
11. CE chine
12. CFLAL/\ chiagsarasaba ; compare final chiag of 10
13. FEY1SL aginkuunosa
14. CILENSL chiusanekanosa
15. YINCILEN kuukachiusaneka
16. YINOF8 kuukamaagla see 1′
17. LEOA∩ sanemȧraba
18. ∩APS baratuno
19. OEPCL manetuchisa
20. O ma
21. N/\ gaba ; gaba, gau, night
22. LEYA sanekura
23. ∩APISL LAO baratuunosa sarama
24. O ma

1′. YIHS OF8 kuukano maagla ; Goi-jaun makilla, the sceptre of God
2′. LEON sanemaka see 4. 9. compare 17, 9′.
3′. N ka
4′. LASL saranosa
5′. 8V8LVS alpilasapino ilbeltz beno compare 7 and 10
6′. CAOA chiramara, zeru marra, heaven limit = the horizon
7′. CILEN chiusaneka see 14
8′. SELFAN nonesaagerka ; non su agerri ka, where fire manifest ?
9′. LEO∩S sanemabano
10′. YLVSC kusapinochi ; eguzbena che
11′. LFSL FELL saagnosa aginsago ; su eginsa aginza go, the burner of offerings
12′. SAYPES norakutuneno ; nora gedenen, to the four quarters
13′. OEYLF∩D manekusa agbatu ; eman eguz *agbatu*, gives the sun——
14′. YLVSC A/\C kusapinochi ; rabachi eguz bena che &c.
15′. YI O SO kuu ma noma
16′. OV8LOAS mapilasamarano ; mopila sa mora-no, the eighteenth

The translations I have suggested in a few cases are merely hints. Of 16′, *mopila sa morano*, I can speak more confidently. It is the only numeral which I recognize as such. No. 21 *gaba* is, I think, correctly rendered by the Basque *gau*, *gaba*, night. Also 6′ *zerumara* or in Basque *zeru marra*, the line or limit of the sky, should mean the horizon. No. 1′ *Goi jaun makilla* should be *sceptrum Jovis* but in note 38 (translation of supposed alphabet) *makilla* is written OL8, not OF8. In 7 and 5′ *ilbeltza* appears, and may indicate the

moon in some phase; literally it means "black month" and now denotes January. In 10, 10′, 14 *kusa* may stand for *eguzki*, the sun. Egubena for *egunbena* or *eguzbena* denotes the fifth day of the week, Thursday, in Basque, but its derivation is obscure. According to Festus, *buris*, the tail of the plough, was an Etruscan word. It may appear in 2 *pikoya buratu*, the extremity or bending of the ploughshare. The Basque verb *burdatu* means to bend, and from it *burdax*, an extremity, is supposed to be derived. Such a term must be astronomical, as the whole of the contents of the Templum appear to be.

With this arcane subject I close for the present my survey of the Etruscan inscriptions, which I have pursued with ever-increasing sympathy for the many and distinguished scholars who have read them by a totally different system, in view of the numerous apparent confirmations of their process, yet with ever-increasing confidence that by that process no light can be shed on Etruscan antiquities nor a solid basis be gained for a consistent reading of the documents themselves. Conscious of its many imperfections, I send this article forth from my study as a first essay in decipherment calling for the honest criticism and collaboration of scholars to whom truth is more than theory, rather than a decipherment itself of the documents with which it deals. Nor can I, in closing, forbear to express to one whose name occurs frequently in these pages, my sense of indebtedness for long hours stolen from the engagements of a busy life to add to my Etruscan material, to read with critical eye the results presented, and to furnish me with many valuable suggestions which cannot but be useful to the student of the new process.

ETRUSCAN VOCABULARY.

In this vocabulary, as in the first reading of the inscriptions in the text, I have given the same conventional phonetic values to the Etruscan characters. Thus I read A as *ra*, O as *ma*, S as *no*, E as *ne*, P as *tu*, &c. For the extent to which this conventional reading may be departed from I refer to the analysis of the syllabary, without a careful study of which this vocabulary cannot be understood.

1. A ra, Basque *ra*, to, towards.
2. A ra, Basque *ara*, interjection, behold.
3. A ra, Basque *ere*, also.
4. A ra, B. *erre*, to burn.

ABC, *raulchi*, B. *iraulzi*, to overthrow.

AC, *rachi*, B. *eritsi*, to esteem, judge.

1. ACE, rachine, B. *eritzen*, fuller infinitive form of the above ; *ne*, the postposition, to.

2. ACE rachine, *erezein* = B. *zein-ere*, however, but in Etruscan whosoever.

AD.AP artu, B. *artu*, to hold, take, receive, treat, lead.

APA artura, B. *ardura*, care.

APE artune, fuller infinitive form of AD.

APNO artukama, B. *artu* and *gomuta*, remembrance, to hold memory.

APNY artukaku, B. *artu* and *gogo*, mind, memory.

APNYLE artukakusane, B. *artu* and *gogatu*, *gogatzen*, to think, dream. In Etr. is a fuller form of the preceding.

AF arag, B. *irago*, to pass, ascend.

AFE aragan, fuller infinitive of AF.

1. AH, AN raka, B. *rako*, towards, for. Also A Ⅎ.

2. AN raka, B. *rako*, as above, but in Etruscan employed as a verb and verbal adjective "to towards," "the towarding," thus meaning approach, offer, present, sympathize, join. As a noun it is the B. *erruki*, *urriki*, compassion, sympathy, regret.

1. ANE, ALE rakane, ragone, the infinitive form of AN.

1. ANA rakora, noun form of the same postposition, an offering or sympathizing.

ANCAD rakachiratu, B. *rako* or *erruki*, and *jardu*, *jardun*, to be occupied = paying attention to.

ANIA rakaura, B. *rako* and *arri*, *harri*, a stone = an offered stone.

2. ANA rakara, B. *erakarri*, cause to bring.

2. ANE rakane, B. *eragin*, cause to make.

ANL rakasa, B. *erakasi*, to teach, cause to learn.

ANM, ANS rakano, synonym of AN and ANA. 1.

AI rau, B. *arau*, rule, right.

AIY rauku, B. *araukide*, conformable, *arauka*, in proportion.

1. AIS, AIM rauno, B. *irion*, to send.

2. AIS rauno, B. *iraun*, continue, endure, persevere.

1. AL rasa, B. *eritsa* or *deritza*, 3 sing. pres. ind. of *eritsi*.

2. AL arsa, B. *urte*, *urthe*, year: Lesghian *reshin*, Circass. *tlaysee*, Georgian *tzelitzadi*.

AM, AS, rano, B. *rano*, synonym of A. 1.

ASY ranoku, Etruscan compound of *rano*, denoting a thing presented, an offering.

1. AM rami, B. *irrin*, *irritu*, split, crack, divide.

2. AM rami, B. *arrunt*, all without exception, whole ; Japanese *aramashi*.

AMA ramira, compound of *mira*, B. *miratu*, to see, and the causative *era* ; *eramira*, cause to see.

AME ramine, compound of B. *imini*, to place, and the causative particle ; *erimini*, cause to place.

AO rama, B. *erama* or *darama*, 3 sing. pres. ind. of *eraman*, to bring ; also stands for the following.

AOE ramane, B. *eraman*, to bring.

AV rapi, synonym of *artu*, agreeing in general meaning with B. *arrapatu*, to seize ; *erpetu*, to claw ; *irabazi*, to gain. It often means hold, take heed, behold !

AVP rapitu, B. *arrapatu*, to seize : a fuller form of AV.

AVLE rapisane, B. *arrapatzen*, another form of the preceding.

AYA, ATA rakura, B. *irakurri*, to read.

AYE rakune, B. *ara* for *arau*, and *gune*, place, standing ; like *ongune*, accord.

A⅄ raba, B. *arreba*, sister of a brother.

1. B ul, B. *al*, *ahal*, power : in Etruscan often used as an adjective.
2. B ul, B. *ahalge*, shame.

BE ulne, B. *almen*, power, dominion.

BINO ulukama, B *al*, *auka*, *eman*, power, choice, to give : the Lucumo, or elected president of the Etruscan confederacy.

C che, B. *che*, even, self.

CA chira, B. *zeru*, heaven, sky.

2. CA chira, B. *ezarri*, to place, set.
3. CA chira, B. *jar*, attention ; also used as a verb in Etruscan.

CAC chirachi, a verb formed from B. *jar*, E. *jarritze*, to pay attention.

CADE chiratune, B. *jardun*, to be occupied with or at.

CAE chirane, fuller verbal form of CA. 3, to pay attention.

CAL chirasa, E. 3. sing. pres. ind. of CAC, and a noun synonym of CA. 3.

1. CE chine, B. *zen*, defunct, late.
2. CE chine, B. *zeña*, who, which.
3. CE chine, B. *zein*, how.

CEI chineu, ? B. *ez*, not, and *nai*, *nahi*, wish = contemn, contempt.

CELA chinegora, B. *chingar*, spark.

1. CI chiu, B. *sei*, six.
2. CI chiu, B. *chehe*, small.

CNL chikasa, from B. *zeken*, niggardly, parsimonious, by changing *en* to *esa*, *zekesa*, the niggard.

CLA chigora, B. *zigor*, a scourge.

CV chipi, B. *chipi*, little.

CVP chipitu, synonym of *chipi*, and used to denote a little one, a child.

CVNC chipikachi, an Etruscan word formed like *azpikache*, the B. *azpikoche*, even a slave. So chipikachi is : "even a child."

1. CL chisa, B. *zazu*, 2 pl. imperat. of *dut*, have ye, do ye have.
2. CL chisa, B. *chitsu*, to precede.
3. CL chisa, B. *izats*, a feather brush without handle.

CLE chisane, B. *etsitzen*, to esteem.

CLVY chisapiku, E. word composed of B. *etsitz* and *beko*, abbreviation of E. *begogo*, consideration, regard = appreciative regard.

CLAN chisa raka, B. *zazu erruki*, have compassion.

CLII chisata ? B. *sistatu*, pierce, or *ezeztatu*, annihilate.

C‡L chiichsa, ? B. *cioten*, they to him do, and imperative *za* = *ciotza*, let them to him.

1. D.P. tu, B. *da*, 3. sing. pres. ind. of *naiz*, he, she, it is.
2. D.P. tu, B. *du*, 3. sing, pres. ind. of *dut*, he, she, it does or has.
3. D.P. tu, B. *eta* of *etan*, *hetan*, &c., old 3. personal pronoun.

DAM, PAM, DAS, Turano, properly Turaan, Tyrrhenia.

1. PE tune, B. *den*, *dena*, who is, he who is.
2. PE tune, B. *duen*, if he has or does. In E. *duen* is categorical, he has or does.

PEY tuneku, B. *tanka*, *tankatu*, strike.

PI tuu, B. *dio*, he to him does.

PV tupi, an E. word meaning "instead of"; perhaps from B. *toki*, place, and *be*, under.

PY tuku, B. *toki*, a place.

II.I ta, perhaps B. *da*, he is : see D. 1.

IV tabe, B. *debe* of *debeku*, prohibition, *debekatu*, forbid.

1. E ne, B. *n*, *en*, sign of dative, to, at, in.
2. E ne, B. *ni*, I, *ene*, my.
3. E ne, B. *n*, *en*, with relative power, who, which.
1. EC nechi, B. *ansi*, care ; in E. more frequently a verb than a noun.
2. EC nechi, B. *neska*, girl, daughter.

ECN nechika, B. *anzeko*, like, similar.

ECV nechipi ? B. *nehabe*, servant, or *inyubi*, fond.

EPI netuu, E. *nituo*, answering to B. *diotet*, I to them do. See EI.

EN neka, B. *neke*, trouble, difficult ; in E. generally a verb, to be unable, fail, have difficulty.

ENA nekara, B. *negar*, *nigar*, tear ; in E. it is a verb without added *egin*.

ENE nekane, B. *negian*, I did.

EI neu, E. *nio*, answering to the B. *diot*, I to him do.

EIN neuka, B. *nayago*, to prefer.

EL nesa, from B. *ansi*, E. 3 sing. pres. ind. of verb, to care for, and noun, care.

ELI nesau, B. *nitzayo*, I to him am.

1. ES neno, B. *nion*, I to him did.
2. ES, EM neno, E. compound postposition, into, for.

EY neku, B. *nai*, *nahitu*, to wish.

E⅄L nebasa, B. *nabusi*, master.

E⅄LO nebasachi, E. *nabusitze*, to command.

1. F ag B. *age*, appearance ; in E. apparently, an interjection, behold !
2. F ag B. *agi* of *agin*, command, promise ; in E. 3. sing. pres. ind. of verb.
3. F ag B. *egi* of *egin*, to do ; in E. 3 sing. pres. ind. and imperat. of verb.
4. F ag B. *igo*, ascend ; in E. 3 sing. pres. ind. or imperat. of verb.

FA ager B. *ageri*, to appear, declaration ; in E. generally a verb, to manifest.

FAS ageran B. *agerrian*, discovered, exposed to view.

FAL agergo B. *ageriko*, verb *ageri*, with future suffix *go*.

FP agtu B. *egit* of *egin*, *egiten*, to do.

1. FE agen B. *agin* ; see F. 2.
2. FE agen B *egin* : see F. 3.

FEP agentu B. *agindu*, fuller form of *agin*, command, promise.

FEL agensa B. *agintza*, promise, offering.

FELA agensara B. *agintzari*, chief, commander.

FNE agkane B. *igokian*, he ascended : in E. equivalent to *iragokian*, he passed.

FI *agu* B. *gai*, apt, capable : in E. means excellent.

FIA agura B. *jayera*, inclination, *jayeratu*, to incline : in E. used as postposition, meaning inclining to.

FIL agusa B. *hatzegin*, to scratch, with inversion *egihatz* : in E. means to write, also.

FIS aguno, composed of B. *age* = *agertu*, declare, and *on*, good : it may mean to show good omens.

1. FL agsa B. *so egin*, with inversion *egi so*, 3. sing. pres. ind. and imperat., to look.
2. FL agsa, formed of *agin*, to command, with contraction, and *sa*, the E. mark of agency : see SEL, CNL. It is the equivalent of *agintzari*.

FY agku, E. compound of *age*, appearance, meaning as *ageko*, a declarer.

F38 agtala, B. *gatillu*, a cup, vase.

H. N ka, B. *ka*, postposition, by.

1. NA kara B. *ekarri*, to bring ; *dakar*, he brings.
2. NA, NNA kara, kakara, E. words meaning a state : perhaps connected with B. *herri*, *erri*, a country.

NAC karachi, B. *ikherreste*, gratitude : compare AC. *eritsi*.

NAL karasa, B. *sortze*, the birth, *natus*, *nata*.

1. NE kane B. *egin*, to make : *kane* is an independent E. verb with the meaning of *egin*.
2. NE kane B. *gan*, postposition, in : in E. it generally means towards.
3. NE kane B. *kian*, *kion*, termination of the past tense of regular verbs : in E. denoting 3 sing., he did.

1. NEI kaneu from B. *gan* as represented by *ganatze*, to attract, is an E. verbal use of the postposition in the 3 sing. pres. ind., meaning, it is towards, *i.e* , it concerns, regards, presents.
2. NEI kaneu ? a combination of NE 3, with the pronominal I, as in LI *zayo*, PI *dio*, EI, *nio*, meaning, he to him did.

NEM kaneno B. *ganaino*, as far as : in E. seems simply to mean towards.

NEY, HEY kaneku B. *ganako*, towards, for : in E. means, that which is given towards, namely a sacrifice or offering.

1. NI kau B *kio*, termination of regular verbs, 3 sing. pres. ind., he does.
2. NI kau B. *kiko*, postposition, for.

NIY kauku ? B. *zahako*, besides, other, outside, beyond.

NL kasa B. *ikasi*, to learn, perhaps in 3 sing. pres. ind.

NV kapi B. *gabe*, postposition, without : in E. often used for the following.

NVD kapitu B. *gabetu*, to deprive, to be deprived.
NVN kapika B. *gabeak*, indigent, deprivation.
NY kaku B. *gogo*, mind, desire, memory.
NYI kakuu, E. dative or locative of *gogo*, answering to B. *gogoan*.
1. ⅃ go B. *go*, sign of genitive.
2. ⅃ go B. *go*, mark of future.
⅃I gou B. *goye*, conversation : in E. it means word, verbal message, intimation.
1. I u B. *au*, *hau*, this : sometimes in E. is personal or possessive rather than demonstrative.
2. I u B. *o* in *o-artu*, heed, attention : comp. Japanese *uya-mau*, to reverence, respect.
1. IA ura B. *aur*, child.
2. IA ura B. *oar*, imperat. of *oartu*, pay attention, take heed.
3. IA ura B. *hiri*, a city.
4. IA ura B. *harri*, *arri*, a stone.
IAP uratu ? B. *orde*, place.
IANYI urakakuu, compound of B. *oroitu*, remember, and *gogo*, in oblique case *gogoi*, meaning to keep in memory.
IAI urau B. *oroi* of *oroitu ;* see above.
IAL urasa, answering to B. *aurkeztu*, to present ; in E. is often a noun, denoting, homage or offering.
IC,K, uchi B. *hitz*, word.
1. IP utu B. *aita*, father.
2. IP utu B. *auta*, *hauta*, choice, to choose.
IPE utune E. *oaten* answering to B. *oartu :* see I.1 and IA.2.
IES uneno B. *hunen*, of this : see I.1.
IE8 unela B. *onela*, thus.
1. IN uka B. *ogei*, *ogoi*, 20.
2. IN uka B. *uga* in *ugatz*, breasts, mother's milk : E. for mother.
3. IN uka B. *ukha*, *ukatu*, to deny, refuse.
INE ukane B. *ukan*, to have, to be.
I⅃ ugo, B. *uko*, refusal, denial.
1. IL usa, B. *atso*, old, now only said of women : in E. it means age, thus answering in meaning to the Basque *adin*.
2. IL usa, E. 3 sing. pres. ind. of B. *utzi*, to leave : read *utza*.
Im umi, B. *hume*, child.
1. IM, IS uno B. *on*, good : in E. also employed as a noun, goodness.
2. IM, IS uno B. *huni*, dative of *hau*, this.
ISAC unorachi B. *oneritsi*, to esteem, love.
ISAL unorasa, the 3. sing. pres. ind. of the above.
ISIS unouno, compound of *on*, good, and E. verb *oan*, *oaten*, to pay attention : see IPE. The verb *onoan* thus means, to pay kind attention.
ISL unosa B. *onetsi*, to esteem good, in 3. sing. pres. ind. : *onetsa*.
ISLE unosane B. *onetzen*, infinitive form of above.
ISLAN unosaraka, attributive form *onetsirik* not found in B. : beloved.

1. IV upi B. *obe*, better : in E. denotes a noble.
2. IV upi, sometimes used for I/\.
3. IV upi B. *opa*, *opatu*, desire, to desire.
1. IVP upitu B. *opatu ;* see above.
2. IVD upitu B, *obeto*, better.

IVP8 upitula ? B. *obi-tille*, a title or inscription on a grave.

IVOI upimau for I/\OI, which see.

I/\ uba B. *obi*, *hobi*, the grave.

I/\OI ubamau B. *obi mai*, a grave-tablet.

1. K uchi B. *hitz*, word.
2. K uchi B. *utzi*, to leave.

KA/\ uchiraba ? *aiserreba*, a plaything.

1. L sa B. *so*, a look ; in E. also used as interjection, Behold !
2. L sa, abbreviation of E. /\L, *basa*, and.
3. L sa B. *su*, fire.
1. LA sara E. three, in B. *hirur*.
2. LA sara, abbreviation of LAP *zarratu*, writing.
3. LA sara B. *sari*, reward, praise : used as noun and verb in E.
4. LA sara B. *zari*, a chief, commander.

LAP saratu, verbal form of B. *zarrapo*, scratching, meaning in E. to engrave, write : is employed as verb, noun and adjective, *zarratu*.

LAF saragi, fuller form of LA. 1.

LAFC saragichi, E. thrice.

LAV sarapi B. *zarrapo*, a synonym of LAP.

LC sachi, an E. verb formed of *so*, look, and the termination *tse : sotze* answers to the B. *so-egin*, to look.

LP satu B. *azti*, a diviner.

1. LE sane B. *zuen*, 3. sing. past ind. of *dut*, he had or did.
2. LE sane B. *zu en*, ye who.
3. LE sane B. *esan*, to say.
4. LE sane from B. *ez*, not ; E. *ezan*, refusal.

LEP sanetu B. *izandaite*, perhaps, in abbreviated form *izanda*.

LF saag B. *so egi*, look !

LN saka B. *so ka*, by the sight.

LI sau B. *zayo*, he to him is.

LM sano B. *asantatze*, build masonry.

LMC sanochi B. *asantze* = *asantatze* ; see above.

LO sama B. *asma*, an indication.

LOT, LOY samaku, E. adjective derived from *asma*, indicating.

LV sapi B. *azpi*, under, below.

LVP sapitu B. *kupida*, comparison.

LVNC sapikache B. *azpiko che*, servant even, even a servant.

LYA sakura ? B. *askor*, joyous : in E. it seems to denote pleasure.

M mi B. *imini*, *ipini*, to place : for fuller form see ME.

MA mira, B. *mira*, *miratu*, to see : in E. also denotes a sight, spectacle, admiration, and regard.

MAP miratu B. *miratu*, to see: in E. often means to show.

MAN miraka, compound of B. *mira*, to see, and *ka*, by.

MAL mirago, E. equivalent of B. *bortz*, five.

1. ME mine, B. *imini*, to place.
2. ME mine, B. *men*, power.
3. ME mine, B. *min*, grief.

MI miu, B. *mea*, *mehe*, small, thin.

ML misa, E. memorial, monument: in Lycian bilinguals = Gr. *mnema*.

MV mipi, E. verb, to send: derivation unknown.

MVD mipitu, fuller form of *mipi*.

MVL mipisa, E. a messenger, envoy: perhaps the original of "embassy, as *imbisa*. Compare the *sa* with that in SEL, CNL, FL.

1. M.S no, B. genitive termination *en*.
2. M.S no, E. oblique cases of E *ni*, I, as: of me, to me, to my.
3. S no B. *no*, hold! behold! when speaking to a woman; when to a man, *to!*
4. S no B. *no*, verbal postpositive, until.
1. SA nora B. *anre*, *andre*, wife, lady.
2. SA nora B. *laur*, four.
3. SA nora B. *narri* of *narritatu*, incite, annoy.
1. SC,MC nochi for B. *aintzi* of *aintzindu*, to present, come before, warn.
2. SC nochi for B. *nau che*, he to me does even, or, he to myself does.

SCE.MCE nochine, B. *aintzin* of *aintzindu*: see SC.1.

SCI nochiu, E. verb, to desire or request: comp. Japanese *nozo-mu*.

MCLE nochisane, B. *aintzitzen*, same as *aintzindu* MC.1.

MPAN noturaka? B. *ondoreak*, descendants.

SPI notuu corresponds to B. *naute*, they me do.

1. SE none, B. *non* where: in E. has also relative power.
2. SE none, answers to B. *noiz*, in sense of: "times."
3. SE none, E. termination of genitive plural.

SEA nonera? E. nine.

MEC.SEC nonechi? E. seven.

SN noka B. *noku*, lack, defect: in E. is a verb, to lack, fail.

SL nogo B. *nagi*, idle.

SI nou, B. *nau*, he me does.

SINV noukapi B. *nau gabe*, he to me does deprivation.

1. ML nosa B. *aintzi*, see SC.1. In E. it is 3 sing. pres. ind. of the verb "to present before, to warn," and a noun meaning a "present," and perhaps "a predecessor."
2. ML - nosa B. *nas*, together: also as ML or MLE it becomes in E. a verb, to be or do together, to unite.

SV.MV nopi B. *nabe* in *nabari*, to see from afar: Japanese *nobe-ru*, to stretch, extend. In E. it is a verb, to extend, put far away, and an adjective, far, extended, great.

MVP.SVP nopitu, fuller E. form of the verb *nabe*, extend.

MY.SY noku, B. *naga* of *nagatu*, to hate.

SYIE nokuune, B. *nuqueyen*, I should have had or done: in the only case in E. it is rather "would that I had."

S/ noba, B. *nebia*, brother.

1. O ma B. *ema* of *eman*, to give: in E. is sometimes infinitive, at others marks the present indicative.
2. O ma, abbreviation of OI, which see.
1. OA mara, B. *marra*, limit, rule, line, stroke: in E. it denotes a monument, probably as *marking* or *defining* the place of sepulture.
2. OA mara B. *amar*, 10.

OANA marakara, compound of *marri* and *ekarri*, a monument, the mark brought.

OANIA marakaura B. *marka*, line, sign, and *harri*, stone, a signal stone or stone of indication.

OANY,OANL *marakaku*, *marakago*, E. compound of *marra* and *gogo*, meaning, a memorial, but the construction of which is not clear.

OAS marano, E. 10th, *amar*, with E. genitive particle *no*.

OPE matune, B. *ematen*, to give.

OII mata B. *emat* of *ematen*.

1. OE mane B. *eman*, to give.
2. OE mane for OL which see.
3. OE mane B. *amona*, mother.

OESA manenora B. *amandria*, lady mother.

OF8,OL8 *maagla*, *magola*, B. *makilla*, stick, staff, rod.

OI mai B. *mai*, *mahi*, table: in E. means a space for an inscription, a tablet. Japanese *ma*, a space.

OL masa B. *emaitza*, a gift.

1. OV mapi E. two: B. two, *bi*.
2. OV mapi E. great; root of B. *ambat*, and original of *ain*.

OVA mapira E. eight.

OVP mapitu B. *ambat*, so much, how great.

OVL mapigo, E. twice; *go*, the genitive sign.

OVS mapino, synonym of preceding: *no*, genitive particle.

OV8 mapila, same as OVA.

O8ES molaneno, same as OAS, tenth.

1. V pi E. 3. sing. pres. ind. of *dut* or a similar auxiliary: now represented by 3. sing. imperat. *bu*. In E. *be*, he has or does.
2. V pi B. *be*, under.

VP pitu B. *epatu* fix a limit; in E. seems to mean, to set, set up, as a monument.

VPE pitune B. *epaten*, fuller infinitive form of above.

VFIL begiusa, a doubtful word. In E. VF is B. *begi*, eye, and *behatz*, consider, is VK or VIC: also IL represents B. *hatz* or *hatza*. If VFIL be a true E. word, IL must be a verbal form of *hatz* answering to B. *atzitu*, seize, take, in 3. sing. pres. ind. or imperat., *hatza*; and the whole will mean, take eye, or behold!

VN pika? abbreviated form of B. *bakidatu*, to communicate.

VNE pikane, fuller infinitive form of above.

VNA pikara, B. *pikor*, a morsel: in E. a small contribution.

VNI pikau, in Cippus of Perusia takes the place of VNY in Eugubin Tables. VNY is formed of V *be*, under, and NY *gogo*, mind, and means regard, consideration; B. equivalent unknown.

VNL pikago, is the same as VNY, *begogo*, and is used as a verb, considering.

VL, VY pigo, piku, an E. word probably connected with B. *bekoki*, forehead, but meaning foremost person, *princeps*.

VI piu? V. 1, with pronominal increment, a synonym of *dio*, he to him does.

VM pimi B. *bean*, below: B. changes final syllables in *m* to *n*. Originally the compound meant "placed under," *be* and *imi*.

VMIC pimiuchi, composed of B. *bean*, placed under, and *oyeche*, better *oyechek*, these even, the whole, meaning "these subjects."

VS pino, B. *banu*, if I had or did: in E. categorical, I had or did.

VO pima, E. one, B. *bat*.

VYE sometimes VNE, pikune, pikane, equivalent of B. *bakar*, alone, only.

Y ku, B. *gu*, we.

1. YA kura, B. *gu ra*, us towards.
2. YA kura, B. *gure*, desirous, *gura*, desire.
3. YA kura, B. *gur*, reverence, salutation.

YP kutu, B. *ekit* of *ekiten*, undertake, attack, begin, advance.

YPE kutune, B. *ekiten*, see above.

YPI kutuu, B. *gede*, *chede*, boundary, end, resolve: used in E. for *chedatu*, limit, define.

YPVY kutupiku, B. *chistmista*, lightning.

1. YE kune B. *gu ri*, to us: E. uses dative and locative *ne* after *gu*.
2. YE kune B. *gune*, place, position, standing, moment, accord.

YN kuka B. *egoki*, to concern, regard, belong to: also as adj. suitable, fit.

YNI kukau B. *dagokio*, 3 sing. pres. ind. of *egoki*.

YI kuu B. *koi*, *khoi*, desirous: in E. is verb, adjective and noun, to desire, desirous, desire.

YIYI kuukuu, E. superlative of reduplication, like B. *onona*, *handihandia*, very desirous, most desirous. It is also used for beloved or dearly beloved.

1. YL kusa, B. *ikusi*, to see; in E. may represent as *ikusa*, 3 sing. pres. ind.
2. YL kusa, probably original of B. *eguzki*, the sun.

YLA kusara, inverted form of *B. era-kusi*, cause to see, show.

YV kupi, B. *jabe*, lord, master.

YVP kupitu, B. *jabetu*, to command, lord it, possess.

8A lara, B. *lur*, earth.

8ANV larakapi, E. word compounded with B. *gabe*, without. It means permission, or without objection.

8AL larasa, B. *lurrez*, pertaining to the earth; in E. = a grave.

8ALMYI laras-anokuu, compound of *lurrezno* = B. *lurrezko*, of earth, and *koya*, a lost word for chamber, receptacle. The whole denotes a tumulus or earthen mound.

8ASYI.8ASY, laranokuu, laranoku, other forms of the above.

8AYE laragune, B. *alargun*, a widow or widower.

8P latu B. *lot*, *lotu*, to bind : in E. also denotes husband or wife, a consort.

8E lane B. *lan*, work : in E. also takes place of *landu*, to work.

8EL lanesa B. *langille*, a workman ; for the formation of the E. word, see OVL, FL, CNL. In E. *sa* marks the agent.

8FI alegiu B. *alegin*, what is possible : in E. *alegio*.

1. 8V alpi B. *alaba*, daughter.

2. 8V alpi B. *albo*, side ; in E. also takes place of B. *alboratu*, to side with, approach.

8VL alpisa B. *alabichi*, god-daughter ; in E. little daughter ?

8VO alpima, fuller form of VO, *pimo*, one, B. *bat*.

/1 ba, B. *ba*, if.

/1A bara, B. *para*, *paratu*, to place.

/1AN baraka, B. *berek*, his, her, its.

/1AYD barakutu, B. *borrokatu*, to wrestle, contend: in E. it means to fight.

/1ATRA barakutura, compound of *borrokatu* and *tar*, a fighter, warrior.

/1A/1A barabara, B. *barbar*, a confused speaker, foreigner, barbarian.

/1A/1AN barabaraka, compound of B. *barre*, *farre*, laughing, smiling : E. *barrebarrek*, the laughing.

/1P batu, E. army ; lost in B., yet the root may appear in *bota*, to hurl, in *fatzea* of *farfatzea*, to fight, etc. This is the Japanese *butsu*, to fight, strike, whence *bushi*, a soldier.

/1E bane, E. to join ; also means, united, and union. Is same as B. *batu*.

/1ED banetu, fuller form of above.

/1EL banesa, B. *banaiz*, if I am : in E. it is categorical, I am.

/1EYP banekutu, perhaps the equivalent of B. *bakidatu*, to communicate.

1. /1I bau, B. *bahi*, a pledge, engagement : in E. also means a consort.

2. /1I bau, B. *bai*, a spot, stain.

/1L basa, E. and ; perhaps B. *baita*, also.

/1LA basara, B. *fetcho*, pretty, dear, with increment.

/1LAN basaraka, form of above, *fetchorik*.

/1LE basane, ? B. *epaitzen*, to cut.

/1M bano, E. within ; ? B. *barruan*.

/1V bapi, B. *paba*, a support, aid : in E. is also a word for father.

/1VIA bapiura, ? *pabe aurre*, forefather or grandfather : from B. *aurre*, before, which makes *aurrekoak*, ancestors.

/1‡A baichra, E. name for a multiplication table.

‡ itch, ich, ? E. verb, to thank.

‡AN itchraka, compound of B. *itcheki*, hold, adhere to, and *rik*, adhering to.

‡DI itchtuu, B. *itsatu*, to hold to, used as a noun, the adherent, in the dative plural: plurality unexpressed, dative by final *i*, *itsatui*.

‡E itchne, B. *etsai*, an enemy, converted by final *n* into an E. verb, to be inimical, *etsain*.

‡EP itchnetu, comp. B. *etsaintasun*, enmity: in E. *etsainta* is an adjective, inimical.

‡NA itchkara, compound of B. *itcheki*, hold to: *itchekiri*, adhering.

‡NAL itchkarasa, the same with mark of agency: *itchekirisa*, the adherent. See SEL, &c.

‡I itchu, B. *etsai*, enemy.

‡L itchsa, B. *itsas* in *itsaskor*, adhering.

‡M itchno, another form of ‡E: the final E and an added E *ne*, to, may constitute the longer M.

‡V itchpi, B. *ichpi*, a morsel: in E. a contribution.

‡VCI itchpichio, B. *ichpicho*, a wager, bet: but in E. same as *ichpi*.

ETRUSCAN PROPER NAMES.

Masculine.

Those of which the sex is doubtful are indicated by a mark of interrogation. Basque names of persons and places are generally significant; so apparently were the Etruscan.

AP. Artu, a Celtic name; in Eugub. Tables, Hertei is king of Umbria.
APY, Artuku, perhaps, Wredech, Feredech, a Pictish name.
APYCE, Artukuchine.
ARR, Artutu.
APMN, Artunoka; comp. Pict. Gairtnoch.
AEL, Arnesa, called Folnius in Latin; perhaps in E. Arnias.
ANA or ANAIN, Rakara or Rakarauka.
AN OAPE, Arka Maratune.
ALNI, Arsakau.
AOVNI, Ramapikau: comp. Ralapika, Rabapika, Laturapika, Artupika.
A8V, Ralapi.
A8VN, Ralapika.
A/\VN, Rabapika; compare Pict. Erp.
? CAP, Chiratu.
CAPCV, Chiratuchipi.
CAPNA, Chiratukara.
CANA, Chirakara.
CAN‡NA, Chirakaitchkara, Latin Caesius, hence Zerukoitchekiri.
? CAL, Chirasa.
CALE, Chirasane.
CALEI, Chirasaneu.
CAVLI, Chirapisau, translated Caulias, hence Zerbazuha in E.
? CAY, Chiraku.
CPAC, Chiturachi.

CEICNA, Chineuchikara ; comp. Pict. Cineoch. Perhaps Sinhetsgarri.
? CELA, Chinesara.
CFENLE, Chiagnekasane may be Cecinna, Sisenna.
CFS‡I, Chiagnoitchu, translated Saturninus.
CNA, Chikara.
CNV, Chikapi.
CICV, Chiuchipi.
CINA, Chiukara.
CL, Chisa, translated Cassius, probably Chisa in E.
CSY, Chinoku.
COMLN, Chimanosaka.
CV, Chipi, translated Sentius, probably Sepe in E.
C/ᒐ, Chiba.
PY, Tuku, translated Tullius, hence Tuku or Idoki in E.
ERN, Netuka, probably Entuka.
FA, Ager, translated Scaevius, probably Ager in E.
FAN, Agerka, translated Scae Calis, probably Agerka in E.
FELIMN, Aginsaumika, translated Volumnius, hence Eginezaumik in E.
FELOVPNA, Aginsamapitukara.
? FESI, Agiṅnou.
FESCV, Aginnochipi.
FEYE, Agingune.
FIACI, Agurachiu.
FISCV, Agiunochipi.
? NALE, Karasane.
NVFI, Kapiagu, translated Alfius, hence Kofegio in E.
N‡, Kaitch, translated Caius, probably Caitch in E. : comp. Pict. Cait.
ᒧIMOM, Goumimami.
? ICIA, Uchiura.
ILE, Usane, translated Vensius, probably Usena in E. : Osin, a Japanese name.
? LAS, Sarano.
LAV, Sarapi, translated Spedius, hence Zarrabe in E.
LAVYN, Sarapikuka.
? LAY, Saraku.
LECNE, Sanechikane, translated Licinius, hence Zuntzegin in E.
LIC, Sauchi.
LSV, Sanopi.
? MAPC, Miratuchi : comp. Pict. Muirethach.
? SFN, Noagka.
MVN, Nopika.
SVD, Nopitu.
SV/ᒧNI, Nopibakau.
OA, Mara, translated Niger, hence Mairu in E. As Mairubaita, comp. Pict. Morbet.
? OPA, Matura.

? OEP, Manetu: comp. Pict. Moneth or Munait.
OVES, Mapineno.
? OVI, Mapio.
? OVMV, Mapinopi.
OYANI, Makurakau: comp. Pict. Maicerce.
VCL, Pichisa, translated Phisius, probably Pisias in E.
VNAYA, Pikarakura, translated Otacilius Rufus, hence Bekarri Gorri in E.
? VKAL, Piuchirasa.
VLN, Pisaka, translated Fuscus, hence probably Pesca in E.
YAD, Kuratu: comp. Pict. Cruidne.
? YAN, Kuraka: comp. Pict. Kirkui.
YAYNA, Kurakukara.
YEYI, Kunekuu.
YNA, Kukara.
YIYI, Kuukuu, translated Titius, hence Koikoi in E.
YIS, Kuuno.
YR, Kutu: comp. Pict. Get and Gede.
YLA, Kusara.
YVD, Kupitu is Cupid.
YVO, Kupima.
8PAVN, Laturapika.
8PB, Latuul, translated Atius or Fatius.
/\P/\, Batuba.
/\V/\, Bapiba, translated Violens; comp. Pictish Fivaid, Latin Fabius.

Feminine.

APVN, Artupika, translated Tiitia.
AL, Argo.
AVL, Arpisa.
AVLA, Arpisara.
AYIV, Arkuupi.
AYVS, Arkupino.
A/\O, Arbama.
CA, Chira is probably Zeru.
CAI, Chirau, translated Cainnia, hence Zerua in E.
CAV/\, Chirapiba.
CA8AY, Chiralaraku, translated Cafatia, hence Zerulurrekoi in E.
CA8AYI, Chiralarakuu, same name.
CPE, Chitune.
CEFL, Chineagsa.
CEIC, Chineuchi.
CVS, Chipino.
FAP, Agertu, translated Varia.
FPAV, Agturapi, translated Bassa.
? FES, Aginno.
F1LI, Agusau, translated Sentia, hence Egihatzau in E.

FI/11, Agubau.
FVISI, Agpiunou.
FVSI, Agpinou.
NAL, HAL, Karasa, translated Aria, perhaps Egurasa in E.
NI, Kau, perhaps Caia.
HON, Kamaka.
LAF, Saraag, translated Lauci, probably Saregi in E.
LEITE, Saneukune.
LIA, Saura.
MAPCI, Miratuchiu.
? MAPIC, Miratuuchi.
MEOL, Minemasa.
MIYPA, Miukutura.
SAD, Noratu, probably Nortia.
MAY, Noraku.
SCIVN, Nochiupika.
SCY, Nochiku.
MII, Nota, Latin Gnata, hence Nata in E.
SVSI, Nopinou.
SYVM, Nokupino.
OVI, Mapiu.
VP, Pitu.
VL, Pisa.
YF, Kuag, translated Arria, perhaps Goegi in E.
YIN, Kuuka.
YIVE, Kuukune.
YIYI, Kuukuu, probably Koikoi.
8ANAC, Larakarachi.
8PEΩ, Latuneba.
ΩAP, Baratu, translated Varia.
ΩADC, Baratuchi.
/1IP, Bautu.

Names of Divinities.

CA, Chira, Zeru, Coelum.
YINA, Kuukara, Goikara.
YINM, Kuukano, Goijaun.
YVD, Kupitu, Cupido.
8EP, Lanetu, Hercules.
‡VN, Itchpika, Istapeko, Venus.

Names of Places.

AL8, Rasala, Rusellae.
AO, Rama, Roma.
? CAI, Chirau.
CALIS, Chirasauno.

CE, Chine, Sena.
CESY, Chinenoku, of Sena.
MVP, Nopitu, ? Nepete.
OAL, Marasa.
VL, Pisa.
YEFAY, Kuneagerku.
YVSNVY, Kupinokapiku.
YVY, Kupiku.

Within the comparatively small compass of this paper, NAL, *sortze* appears 30 times, IA, *aur* 20, NA, *andre* 26, and IN, *uga* 9. The verb LAD, *zarratu*, alone or in composition with OI *mai*, appears about 50 times, AP *artu*, 33, NEI *ganio*, 31, AL *eritza*, 35, NA *ekarri*, 27. The word FEL, *aginza*, exclusive of its appearance in proper names, occurs 30 times; NY, *gogo*, occurs 20 times, and NO, *gomu*, 15. OA, *marra*, appears in *marakara* 11 times and as often in other connections. The word IL, *atso*, occurs 13 times, the postposition AS, *rano*, 15, and the adverb or relative SE, *non*, 18. These sixteen fairly determined Basque words thus represent about 400 of the words presented in the inscriptions here set forth, and make the reading of Etruscan a simple matter.

ADDENDA.

The following, extracted from Deecke and compared with the copies in Fabretti's three supplements and Gamurrini's Appendix, have just been sent me by Mr. VanderSmissen. The first number is Deecke's; F. 1, F. 2, F. 3, denote respectively the three supplements of Fabretti; and A. marks the Appendix.

4. F. 3, No. 105. *Lat.*—A · FABI · IVCNVS
Etr.—AV 8A/ILAPOIAL
arpi larabausaratumaurasa
arde ilhar abe zarratu mai eritsa
behold Bean prop written tablet esteems

The Basque *ilhar* translates the French *haricot*. The Etruscan shows that the medial *h* is no part of the original word. The only term in modern Basque that approaches the form of the Etruscan *bai* and the meaning of the Latin *juncus*, which I suppose is what the scribe meant by *jucnus*, is *abe*, a prop, stay, tree. This must surely be the original Jack of the Bean-stalk, whom I had not expected to have the pleasure of meeting among the graveyards of Etruria.

5. A. 401, Tav. VI. *Lat.*—AR · TRIIBI · HISTRO
Etr.—AO · YPE/ΛI · OANA · SA
rama kutunebau marakara anre
erama Kutunebai Marakara andre
it bears Kutunebai Marakara's wife

What the sculptor meant by Kutunebai as Triibis I cannot imagine. The Etr. *kutune* answers generally to the Basque *ekiten*, to undertake; hence *bahi ekiten* would mean to undertake a pledge, or to engage oneself. The name Marakara is identical in form with the term commonly designating a memorial. Here, however, it translates Histro, itself an Etruscan word. The B. *arrokeria* means boasting, romancing, rodomontade; *marraka*, which seems to connect with it, means any strange noise, such as mewing, bellowing, bleating. The element *mara* appears, a little altered in form, in *churimuri*, *zurumuru*, a vague rumour, the final *muru* denoting the noise or sound. The modern B. word for the poet or improviser is *koblakari*, *kobla* being a Provençal term meaning strophe or stanza. He is thus a stanza-bearer; and the *mara*, *marra* or *murukari* must have been the bearer of strange or inflated sounds, the actor.

8. A. 719, Tav. VIII. *Lat.*—L · SCARPVS · SCARPIAE · L · TVcIPA
Etr.—LAPNO · SCAP/ΛP · LAVYNI

In the Etr. the /ΛP of SCAP/ΛP are peculiar in form, the /Λ being rounded at the top and the P having a lower horizontal limb, making it appear like a combination of P and L. Also final YNI are indistinct.

zaratu kama · nochiratubatu · sarapikukau
zarratu gomu no jarri du Batu Sarapi egokio
written memorial which present does Batu Sarapi concerns

The name Scarpus is the Basque Sarapi, probably pronounced Sharpi. That most unclassical word Tucipa translates Batu, the common Etr. word for an army, which I have already shewn the relation of to the Jap. *butsu*, to fight and *bushi*, a soldier. It must, therefore, be a barbarous derivation from the Greek *teuchea*, answering to *teuchophoros*, an armed man.

9. A. 774, Tav. IX., is on a seal. The first line, supposed to be Latin, is, in the original, written from right to left: the second, from left to right. The initial letter of the first line is obscure, and so are the two in the second, which I have treated as Y or T.

/EL · ΛAX
REL · TETII
banesa para ku banaiz parago
tunesa · kunekuda duenza gune gudu

"I will be placed for who does to us fight;" which I suppose means "I am at the disposition of any one who wishes to attack us." It is thus probably an armorial motto. The Etr. equivalent of the B. *naiz*, namely *banaiz*, is now well known. The verb *para*, *paratu* to place, extend, is in the future with the suffix *go*. The compound *duenza* consists of *duen*, who does or has, and *z*, the post-position. In the Eugubine Tables YII denotes the modern *gudu*, a fight, in distinction from YP, now *ekit*, undertake. In Etr. *guda* or *gudu* is a verbal form. There is no Latin in the inscription.

15. *Lat.*—C · ANNIVS · L · F · COELIA · GNAT
Etr.—FEL · ANNE · CV/ΛSNAL
aginza rakakane chipibanokarasa
aginza Erkaka ne Chipibano sortze
offering Erkaka to Chipibano *natus*

The name Annius must stand for Annulus. The B. for ring is *erhaztun*, from *erhi*, the finger. Finger-tip is *erkain*. The Jap. *kake*, to hang, hook, put on, &c., which makes *kake-gane*, a ring and staple for fastening a door, agrees with the B. *kako*, translated by the French *crochet*. I suppose, therefore, an old B. or Etr. word *erkaka*, a finger ring. The translation of Coelia by Chipibano I cannot explain. Were the second character A instead of V, some sense might be made of *zerubano*.

17. *Lat.*—C · ARRIVS · C · F · Q
Etr.—AO · APNYNI · VMPANAL
rama artukakukau pimiturakarasa
erama Artukakukai Bemitura sortze
it bears Artukaku Kai Bemitura *natus*

Artukaku, or in modern B. *artugogo*, means, to hold the memory, and is a common formula in sepulchral inscriptions. Here it is a proper name. It may have been used technically to denote the *arrha* or earnest money which kept the seller in mind of the bargain with the intending purchaser. The final Kai is, I think, an Etr. form of Caius.

18. *Lat.*—C · ARRI · ARN · ARRIA · NAT
Etr.—APN · APNYNI · APPI
APNYNAL
artuka artukakukau artu tuu
artukaku karasa
artuka Artukaku Kai artu dio
Artukaku sortze
receptacle Artugogo Kai receive it him does
Artugogo *natus*

Here, I think, the playful fancy of the Etruscan scribe has disported itself in heaping up *artu's*. The only doubtful word is *artuka*, literally, by holding, which I read receptacle, that which contains.

22. F. 3, No. 101. *Lat.*—Q · SCRIBONIVS · C · F
Etr.- FL · ‡ICV
ag sa ich u chi pi
egi so Ichauspe
behold Ichauspe

The exclamation or imperative would now read *so egi*. Ichauspe is a very Basque looking word, but I do not know how it translates Scribonius. To shut, enclose or hold, is *ich*, and ICV may be *hitz be*, under word, or *ospe*, sound, fame, renown. The compound is not in any Basque lexicon known to me. The Basque has lost its original words denoting writing, and letters generally.

Three other Scribonius inscriptions were found in company with the above, one in Latin and two in Etruscan.

F. 3, No. 102. A · SCRIBON
C · F
F. 3, No. 99. FL · ‡ICV · VL · mVYVAL
F. 3, No. 100. FL · ‡ICV · FL · mVY
egi so ichauspe pisa mipikupirasa
egi so ichauspe egiso mipiku

A comparison of the two latter leads me to regard Mipi, Mebe as a local name, answering in a measure to Meva in Mevania. Thus I read No. 99:

egi so Ichauspe Pisa Mebe jabe eritsa
behold Ichauspe: Pisa Mebe's lord esteems

Pisa is a woman's name, and may be the widow of Ichauspe. I read No. 100:

egi so Ichauspe egi so Mebego
behold Ichauspe behold Mebe of

The genitive Mebego will be equivalent to "a native of Mebe."

27. A. No. 402, Tav. VI. L · ⅄FPNI · L · 8
L · ⅄VRNI · L · F

The upper line is written in the original from right to left. The F of the second group is archaic, as are the L and 8 which constitute the third and fourth groups. The L is of the same form as that which appears in the *azti* of Atius, the haruspex (page 213). If the lower line be Latin it affords an argument in favour of the present reading of Etruscan. Translating it tentatively as Etruscan, I make:

zu abegi Tukau azi Al
sa babe Tukau so egi
"you welcomes Tukau's progeny Alsa; father Tukau behold."

The B. noun *abegi*, welcome, I treat as an Etr. verb. In B. *azi* means seed, and also to nourish, train, bring up: hence it may be an old word for *aur*, child, or *seme*, son. The separation of the word Alsa into two parts is not without parallel, but tells against the translation given.

26. 8EDINA
MLABRI

These two lines, the first of which I have inverted, are found on different sides of an amphora. Neither can be Latin. They may read:

lanetu Ukara
Nosara ahal dio
"The Lanth Ukara—he governs Nuceria."

The word *lanetu* I have already referred to as an officer in the Etruscan confederacy frequently mentioned in the Eugubine Tables. The noun *al*, *ahal*, power, here conjugated with *dut* in its compound pronominal form, must be a verb meaning to exercise power, to govern. Nuceria, however, is a city name belonging to Campania, Umbria and Cisalpine Gaul.

27. A. No. 754, Tav. VIII. OA · FENI · LA
SIITRA

The upper line of this also was written from right to left. The T of the lower line is in the original a compound character, a semi-

circle above the base giving it the appearance of a tripod. I suppose it, therefore, to be composed of Ⅼ and Ⅴ and to represent *gogo*.

mara · Aginkau · Sara
no di gogotu ra
memorial Aginkai Sorano from to remember

Here again a proper name is separated by the lines. The inscription was found between Bolsena, the ancient Vulsinii, and Sorano, which is not mentioned by the classical geographers. The postposition *di* or *dik* from, by, after, out of, is well represented by II, the first element in *debe*.

29. A. 954.

LO . . . . . CINAE · B
LO . . . . . C · IVPIC ·
AO . . . . . AM · COIFCE
A . . . . . EREITO . QVES
)VAME

I do not think it possible to make Latin of the right or perfect side. Of the mutilated left, *asma, asma, erama, ra,* give no connected sense. The right reads in Etruscan :

chiukarane · ahal
chi · upituuchi ·
rano · chimauagchine
netuneukuma · mipineno
chipiranone

I read Q as *mi* and the inverted C as if it were not inverted :

Chiukarane · al	Chiukarane · poten-
tzu · obeto hitz ·	-tate · best word ·
rano ., seme au Agizen	towards · son Agizen
entun uko ema · imbe nion	to obey refusal giving · send I him did
chipi ranone	the youth to reconcile

Chiukarane is evidently the name of a place. It can hardly denote Clusium, where the bronze plate containing the inscription was found. The following *alchi, altsi*, analogous in form to the B. *altsu*, powerful, I suppose to be an Etr. noun, the power-holder or potentate, governing Chiukarane in the genitive of position. Literally *obeto hitz rano* means "towards the better word." It is probably a polite acknowledgment, answering to the hackneyed "your esteemed favour" of the English letter-writer. The following *seme,*

in Etr. *sema*, denotes a son, and *au*, this, appears to have possessive value, his son. His name Agizen or Agizene may relate to *agitz*, vigorous. The B. *entzun*, to hear, obey, is *entu*, *entun* in Etr., and is of common occurrence in the Eugubine Tables. The other words, *uko* and *ema*, have already occurred. I regard Q as the equivalent of O with a perpendicular line from the base, employed as m, just as O with a dot in the centre is in Celtiberian. The verb *ranone* appears in the Eug. Tab. with the meaning, surrender, come to, take part with. It is a verbal form of *rano*, the postposition "towards."

F. 726. · 8ASYI · YLESNEI · LAYINIAL
CENCVNIA

The upper line, written from right to left, is found upon the lid of an urn, and the lower, as given, upon the urn itself.

laranokuu · kusanenokaneu · sarakuukaurasa
chinekachipikaura
lurreno koya Kusaneno ganio Saraku uga au eritsa
zen Kachipika aur
earthen receptacle Kusaneno concerns Saraku mother his esteems
late Kachipika's child.

A. 41, Tav. II., is the inscription on a cup:

MIVNEI · AM

The first character is not M, but one repeating the upper angle of this letter, and wanting the final perpendicular. I find it with I, taking the place of OI, *mai*, in Lanzi, Saggio, No. 322:

MIADNO mai artu gomu
No. 323. MILAPVM mai zarratu pino

I therefore read the inscription:

mai Pikaneu rano
inscription Pikaneu towards

The most interesting of these inscriptions from a philological point of view is the first (4. F. 3, No. 105). The Etr. and B. *ilar*, which translates the Latin *faba*, is the root of *illargi*, the B. word for the moon. The connection may have arisen out of the shape of the bean, or from a belief in the fable reported by Pliny (H. N. XVIII., 30), that the bean is the only grain that swells with the waxing moon. In the Hittite and Aztec hieroglyphic systems the bean has a place.

In the former its phonetic value is *ha*, constituting the first syllable in the word Hamath (Hittite Inscription, H. V., line 2). In the latter it has the values *e*, *eu*, bean being *etl* in Aztec. The Aztec hieroglyphic for *atl*, water, takes the place of the bean in the Hittite H. V., line 3, showing that *ha* was the original power of both symbols. Pliny (*loc. cit.*) speaks of religious practices connected with the bean among the Romans. It was regarded as impure by the Egyptian priests (Herodot. II. 37, Diod. Sic. I. 89), and by the Pythagoreans (Diog. Laert. VIII., 19, 21), who are supposed to have derived their lore from Egypt. The reasons for the aversion of the Egyptians and the regard of the Romans for this vegetable are historical. The lunar and bean name *ilar* or *hilar* was a tribal one, denoting a Hittite family, the Alarodians of Herodotus and the Allurians of the Assyrian monuments who dwelt in Armenia, the Illyrians opposite Italy, the Ilergetes and Ilercaones of Spain, and the Silures of Britain. Iluro, now Oléron, north of the Pyrenees, represents the same word. It was connected by the classical geographers with Lapurdum, whence the Basque Lapurta or the Labourd, just as Illyria connects with Liburnia, and Allapur with Alluria. So also Etruria furnishes Solaria and Portus Liburni, and in Liguria we find Ad Solaria and Libarna. When the Lupercalia were instituted at Rome, two families were appointed to preside over them, the Quintiliani and the Fabiani (Festus, 87). The latter, like the Fabii, were doubtless Etruscan Ilars, who understood the rites of the old Accadian Lubara, god of pestilence, and worshipped him under the twin names Lupercus and Februus. For the connection of this ancient deity with Jupiter Labradeus of Caria and the Irish royal hero Labradh Loingseach, see my essay on Monumental Evidence of an Iberian population of the British Islands, in Trans. Celtic Society of Montreal, Vol. I.

SEVENTEENTH ORDINARY MEETING.

The Seventeenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, March 7th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges was read :

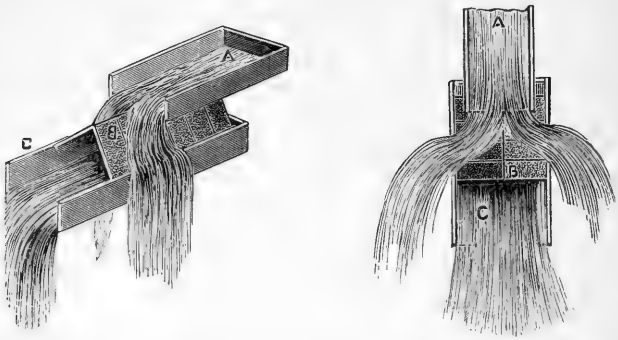
1. Transactions of the Manitoba Historical and Scientific Society, Nos. 12—18, Annual Report for 1884-5.
2. Canadian Practitioner, Vol. X., No. 3, March, 1885.
3. Science, Vol. V., No. 108, February 27, 1885.
4. American Journal of Science, March, 1885.
5. Monthly Notices of the Royal Astronomical Society, Vol. XLV., No. 3, January, 1885.
6. Journal of the Royal Microscopical Society, Series II., Vol. V., Part 1, February, 1885.
7. Bulletin de la Société Géologique de France, 3*e* Série, Tome XIII., 1885, No. 1.

Mr. T. H. Lennox was elected a member.

Mr. Charles Levey read a paper on "Gold Mining on the Saskatchewan," of which the following is an abstract :

The gold fields referred to are at and near Edmonton, on the North Saskatchewan River, N. W. T., Canada. The deposit, through which the present river cuts, is said to extend some sixty miles east and west. The northern and southern limits are not known. The thickness of the deposit is partly seen by the height of the river banks which, at the point referred to, are at least two hundred feet high. At the highest points, on some of these banks, gold can be washed out, but the quantity per cubic yard of dirt increases as we near the present water level. On the gravel bars the yield by hand working is about $1.60 per cubic yard. The gold is in the shape of very fine dust and minute nuggets. The largest of these nuggets is not larger than the smallest mustard seed. The hand-mode of separating the gold from the dirt will be understood by reference to the sketches in which A is the Dump Box, B the Grisley, and C the Blanket Box. The Dump Box is filled with gravel, after which water is dashed upon it by the aid of a long handled dipper. This

washes the gravel from A to B. The coarse parts fall on either side of the double-inclined grate, while the finer parts fall through the



grates on to the blankets in the box C; all but the black sand and the gold are discharged. The latter adheres to the blankets. The Dump Box is filled and emptied repeatedly for say ten hours, after which the blanket is washed in an ordinary tub, to the bottom of which the gold and black sand fall. The water is next poured off, and two or three charges of fresh water are poured into and out of the tub in order to further cleanse the gold and black sand. When these are sufficiently clean, they are removed from the tub to the gold pan. This is done by tipping the tub over the pan, and then by dashing water from the pan into the tub. The gold cannot be successfully removed from the tub in any other way. The pan is now held under water and shaken until the mass it contains is much reduced in bulk, by the separation of the lighter portions of the sand. Some quicksilver is poured in, together with clean water, and the pan is shaken until the quick silver has taken up all the gold. It is then again placed under water, and violently shaken to remove all the black sand. The remaining contents are then poured into a wash-leather which has been previously wetted and stretched. The edges of the leather are secured in the right hand, when the centre of it assumes the shape of a pounce. The neck of this is wrung until all the free quicksilver is squeezed through the pores of the leather, and falls in fine beads into the pan placed for its reception. When opened the bag is found to contain a ball of amalgam of silver colour and of about the consistency of putty. This is moulded in the fingers to the required shape, and then placed upon an iron shovel.

Heat is applied beneath the shovel to drive off the quicksilver that could not be removed by pressure. After a sufficient application of heat, the button of amalgam assumes a gold colour and is allowed to cool. This is the gold amalgam of commerce.

The rest of the paper was descriptive of the machine methods of recovering the gold.

In answer to questions from Messrs. Murray, Miles, Bain, Livingston and others, Mr. Levey said that hand-work had been going on for nine years, and machinery work five years; the first was not commonly satisfactory, and the other produced about $6 per day; that the tract was 200 miles north of Calgary, and extended 50 miles; that the yield per pan was about two cents; that the sand contained magnetic iron and a little platinum; that there were from 1,500 to 2,000 settlers; that there were large boulders of gneiss and granite which, he thought, came from the Laurentian to the north-east; and he thought hydraulic mining would pay after a very large expenditure.

EIGHTEENTH ORDINARY MEETING.

The Eighteenth Ordinary Meeting was held on Saturday, 14th March, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges was read:

1. "Some Historical Names of Places of the Canadian North-west." By Charles N. Bell, Esq.
   "Our Northern Waters." By the same. Presented by the Author.
2. Science, Vol. V., No. 109, March 6th, 1885.
3. Journal of the Franklin Institute, March, 1885.
4. Essex Institute, Historical Collections, Vol. XXI., Nos. 4, 5, 6, April, May and June, 1884.
5. The Pennsylvania Magazine of History and Biography, No. 32. Vol. VIII., No. 4, December, 1884.
6. Trübner's American, European, and Oriental Literary Record, Nos. 205–206.
7. Annual Report and Proceedings of the Belfast Naturalists' Field Club, 1883–84, Series II., Vol. II., Part IV.
8. Journal of the Tuckett Microscopical Club, Series II., Vol. II., No. 11 March, 1885.

9. Journal of the Asiatic Society of Bengal, Vol. LII., Part II., 1883. Proceedings of the Asiatic Society of Bengal, No. X., November, 1884.
10. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XI., Nos. 6–10, Sitzungen vom 7 Juni, bis 29 November, 1884.

Mr. A. McCharles read a paper on "The Extinct Cuttle-Fish in the Canadian North-west."

This paper has been separately published by the author.

In answer to a question by the President Mr. McCharles said sixteen species had been found.

Mr. McDougall remarked on the immense number of shells he had observed in the sand at Selkirk, and with reference to the S. E. glacial drift meeting the other S. W. one suggested that possibly it might be the same drift which had turned N. W. at the supposed place of meeting.

Mr. Bain objected to this that there was no dividing ridge, but that the western limit of the Laurentians was the Lake of the Woods.

Mr. Levey drew attention to the occurrence of boulders in clusters, and stated that in the Lake of the Woods some islands were Laurentian, others Silurian.

Mr. Dale, referring to the interesting specimen produced, alluded to the too extended use of the term "cuttlefish," which should properly be restricted to the belemnites.

Mr. Livingston having asked if any theory was proposed to account for two glacial flows, Mr. McCharles said that it was supposed at that time the Red River flowed south and was a branch of the Mississippi.

NINETEENTH ORDINARY MEETING.

The Nineteenth Ordinary meeting was held on Saturday, 21st March 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

Mr. VanderSmissen presented the following Report from the Committee appointed to consider the advisability of

dividing the Institute into sections, in accordance with the suggestions contained in the President's Inaugural Address.

To the Members of the Canadian Institute :

"Your Committee beg to recommend that the Institute should request the Natural History Society to appoint a Committee from that body, to confer with them on the best mode of dealing with the recommendations and suggestions contained in the Address."

On motion by Mr. VanderSmissen, seconded by Mr. Marling, the Report was adopted.

It was moved by Mr. Marling, seconded by Dr. Kennedy, and carried, "That the Secretary be instructed to correspond with the Secretary of the Natural History Society, requesting him to convey the wish that the Society would appoint a Committee to meet a Committee of the Institute."

The following list of donations and exchanges was read :

1. Monthly Weather Review, Dominion of Canada, for February, 1885.
2. "On the Superficial Deposits and Glaciations of the District in the Vicinity of the Bow and Belly Rivers," by George M. Dawson, D.S.F.G.S., F.R.S.C. Presented by the Author.
3. Proceedings of the American Antiquarian Society, N.S., Vol. III., Part 3.
4. Science, Vol. V., No. 110, March 13th, 1885.
5. Minutes and Proceedings of the Institution of Civil Engineers, Name-Index, Vols. I. to LVIII., Sessions 1837 to 1878–'79.
6. Proceedings of the Royal Geographical Society, Vol. VII., No. 3, N.S., March, 1885.
7. Correspondenz-Blatt der Deutschen Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, XVI. Jahrgang, No. 1 u 2, Januar und Februar, 1885.
8. Le Globe, Journal Géographique, Organe de la Société de Géographie de Genéve, Tome XXIV., Quatrième Série, Tome IV. Bulletin No. 1, Novembre, 1884—Janvier, 1885.

Mr William Dick was elected a member.

Mr. A. B. Macallum, B.A., read the following paper on "The Alimentary Canal in Ganoid Fishes :"*

The Alimentary Canal in *Acipenser*, *Amia*, and *Lepidosteus* shows several peculiarities of structure over and above what are

* The subject-matter of this short description is treated more fully in a paper communicated to the English Journal of Anatomy and Physiology

usually observed in fishes. In some respects these peculiarities may be considered as due to a derivation accompanied by little differentiation from structures which were probably present in the primitive type of fishes.

Of these, pouch-like deverticula of the epithelium in the œsophageal portion of the fore-gut in the genera named, are in their inflated portion wholly lined by flattened, almost squamous, epithelial cells, each with a flattened nucleus and a quantity of clear protoplasm. The cells in the neck of the pouch are cylindrical, strongly ciliated, and but little differentiated from the common epithelial cells of the œsophageal mucous membrane. The neck varies much in diameter and length, being as a rule about half the diameter of the inflated portion. Pouches of this description are most highly developed in *Acipenser*, least so in *Lepidosteus*. It is impossible to say at present what their function is, but I believe that it is transudatory. They are not glandular in the present definite acceptation of the word, and they cannot be for the purpose of absorbing digested food matter, since they are too far in front of the seat of digestive changes. I have seen no description of like structures as occurring in any other vertebrate.

The œsophageal portion of the fore-gut in *Amia* and *Acipenser* possesses glands similar to those found in the stomach in the same genera, and which undoubtedly secrete pepsin. In this same part of the fore-gut there are gland tubules which, in the cells lining them, show all the degrees of differentiation from a simple epithelial crypt to a fully formed peptic gland tubule. In the same two general œsophagus and stomach act together as a digestive structure, both being provided with peptic glands. In *Acipenser* the part of the fore-gut which has hitherto been termed the œsophagus, possesses taste-buds in large numbers and cannot, therefore, be rightly so named. The part following it, and terminating behind the mouth of the air duct, must, from the histological structure, be considered as the œsophagus.

The lining epithelium of the œsophagus in *Acipenser* and *Lepidosteus*, and that in œsophagus and stomach in *Amia*, is ciliated. In all, the stomach possesses peptic glands of the type usual in fishes. In *Acipenser*, glands of this character have been previously overlooked, Leydig having described as such the ordinary epithelial insinkings, or crypts, into which the true glands open.

In the mid-gut and end-gut the epithelium is ciliated, the size of the cilia differing greatly, sometimes being so delicate as to resemble the exceedingly fine protoplasmic processes of the same cells in higher vertebrates. Epithelial insinkings and tubules, to which one can with difficulty attribute a glandular function, are present in large numbers in both sections. The epithelium forming them is ciliated, and contains a number of beaker cells. These tubules are undoubtedly the homologues of the Lieberkühnian glands in higher vertebrates.

In *Acipenser*, tubules are present in the mucous membrane of the spiral valve, which are distinguished from those of the neighboring wall of the intestine, in that they are longer and slenderer than those, the cilia of the cells forming them being shorter and more delicate, while beaker cells are wholly absent, but abundantly present in the tubules of the usual kind. Such structures are not very numerous, and it may be that a study of fresh material may show them to be not materially different from the others. In this genus also the epithelium of the spiral valve is very strongly ciliated, and its shallow crypts are abundantly supplied with beaker cells.

One important point in connection with the histology of the spiral valve in *Acipenser* has yet to be noticed. Usually the valve is thick, and a cross section of it shows to what the greater part of this thickness is due : lymph follicles, often over a dozen in number in a single vertical section. Hyrtl described a large lymph organ as forming the greater part of the thickness of the valve in *Acipenser ruthenus*, and Ayers has found something similar in this species and in *Lepidosiren*. These follicles in *Acipenser rubicundus* are, in all probability, the homologues of Peyer's patches which are therefore, so far as is yet known, confined in fishes to *Acipenser* and *Lepidosiren*.

In *Amia* the epithelium of the mucous membrane is ciliated from the pharynx to the vent. Cilia are present in the same extent in *Acipenser* and *Lepidosteus*, except in the stomach.

The pyloric appendage in *Acipenser* and *Lepidosteus* is lined on its inner surface by epithelium, resembling in every respect that of the mid-gut, and completely lacking a glandular character. These appendages, in some other fishes, have been found to secrete pepsin, trypsin, and diastase. This is not the case in *Acipenser ;* no enzymes were found when proper precautions were taken to remove the mucus and food matter, which usually gains an entrance by the

mouth of the large duct of the organ from the chyme as it escapes from the stomach, and which contains traces of pepsin. Trypsin may gain an entrance also, as the pancreatic secretion is poured into the canal nearly opposite the opening of the appendage. Without taking the precaution of removing the matter present, traces of all the enzymes named were found in the extracts of the appendage. Krukenberg came to a different result with *Acipenser ruthenus*, having found the enzymes normally present in the organ.

A pancreas is present in the three genera. This organ in *Acipenser* is disseminated through the right half of the peritoneal cavity in the liver, and between it and the valvate portion of the mid-gut. The distribution of the pancreatic tubules seems to follow wholly the course of the branches of the *arteria cœliaco-mesenterica*, about which they entwine. The duct of the organ opens on the same papilla on the inner wall of the intestine with the bile duct. This papilla is placed about a centimetre from the tip of the pyloric valve. The tubules of the pancreas are much similar to those observed in other fishes, except that structures analogous to the centro-acinar cells of Langerhans have been observed in them.

A pancreas has been described by Balfour and Parker as occurring in young *Lepidostei* in the form of a rounded organ, situated on the posterior face of the pyloric portion of the mid-gut. I find the pancreas in *Lepidosteus* to be much more extended, its tubules being partly imbedded in the dorsal face of the posterior two-thirds of the liver, and partly entwined about the portal vein, as far back as the posterior border of the pyloric appendage. The organ which was considered by Balfour and Parker to be the pancreas, seems to be an accessory spleen for the greater part, with a few pancreatic tubules in it. The duct of the pancreas opens in common with the bile duct into the intestine, the junction of the two taking place immediately outside the intestinal wall.

A pancreas has not hitherto been found in *Amia*. The reason is that it is imbedded to a large extent in the liver, forming the greater part of the bridge between the right and left lobes. The tubules are arranged about the larger interlobular branches of the portal vein. The duct passes straight backwards, to open beside the bile duct into the mid-gut near the pyloric valve.

Mr. Boyle doubted the statement that the digestive process in snakes is rapid; his experience with snakes and alligators was to the contrary.

Mr. Loudon also held this opinion.

Mr. Macallum replied that animals in captivity or fear do not digest rapidly; otherwise they do.

Mr. J. A. Livingston then read a paper on "New Discoveries in Gravitation and its Correlations."

The physical circumstances which modify or enhance the digestive process do not differ in any marked characteristic from those of the higher animals save one: the temperature required is considerably lower. The enzymes seem to have more vigorous action than those of mammals and birds. In the sturgeon, digestion is very rapid, resembling in this respect the process as found in reptiles. In the case of the latter, several specimens of *Storeria* digested frogs of small size in less than an hour; and similar experiments were made with the sturgeon with quite the same results.

TWENTIETH ORDINARY MEETING.

The Twentieth Ordinary Meeting was held on Saturday, 28th March, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

Messrs. Carpmael and Livingston were appointed auditors for the year.

The following list of donations and exchanges was read:

1. Report on Canadian Archives by Douglas Brymner, Archivist, 1884.
2. The Pennsylvanian Magazine of History and Biography, Nos. 30 and 31. Vol. VIII., Nos. 2 and 3, June and October, 1884.
3. Transactions of the American Society of Civil Engineers, December, 1884.
4. Selected Papers of the Rensselaer Society of Engineers, Troy, N.Y., Vol. I., No. 2, March, 1885.
5. Science, Vol. V., No. 111, March 20, 1885.
6. Annual Report of the Trustees of the American Museum of Natura History, Central Park, N.Y., for 1884-'85.

7. Bulletin of the Illinois State Laboratory of Natural History, Normal, Illinois, Vol. II., 1884.
8. Description of a New Species of Crinoids with Articulating Spines, by George Jennings Hinde, Ph. D., F.G.S.
9. Proceedings of the London Mathematical Society, Nos. 231–234.
10. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Sitzungen vom 18 Oct., 1884, und 15 Nov., 1884.
11. The National Anthem for India, with Translations into several Oriental Languages.

    An Account of the Proceedings of a Meeting held in the National Club, Whitehall, with the Speeches in favor of the Anthem Movement.

    Report of a Meeting in Grosvenor House, &c., on the same.
    Presented by Henry Rowsell, Esq.

Mr. A. McCharles was elected a member.

Mr. A. B. Macallum, B.A., Fellow of University College, read the following paper on

THE NERVE ENDINGS IN THE CUTANEOUS EPITHELIUM OF THE TADPOLE.

The results attained in the study of this subject have given the following : *

1. There are two plexuses of non-medullated fibres, one wide-meshed, placed some distance below the corium, the other very narrow-meshed, situated immediately beneath the epithelium. The first, which may be termed the primary or fundamental plexus, sends up fibres at various distances which pierce the corium and unite with the secondary or subepithelial plexus. The meshes of the latter are often as narrow as the basal surface of an epithelial cell.

2. From the primary plexus, fibres here and there pass up through the corium to terminate in swollen bead-like bodies between the epithelial cells.

3. From the secondary plexus arise minute fibres, which, ascending between the epithelial cells, terminate either within the latter near their nuclei, or between them, or after branching in both fashions.

4. The fibres which enter cells of the basal and intermediate layers of epithelium, are provided with sheathing structures known as the Figures of Eberth, which decrease in size as the cells con-

* The points treated of in the first part of this abstract, are dealt with fully in a paper published in the Quarterly Journal of Microscopical Science for November, 1885.

taining them show fewer and fewer signs of vitality, that is, as the cells progress towards the superficial layer of the epithelium the Figures of Eberth diminish in size, and in the superficial layer vanish almost completely. This, I think, is an indication that the Figures of Eberth protect the intracellular ends of the nerve fibrils from the vital processes of the cells.

A further study on the same subject has given the following results:

1. The Figures of Eberth are the secretion or rather the production of the intracellular ends of the nerve fibrils, and are not formed from or by the cell protoplasm. This is seen in cases where a Figure of Eberth may be continued outside the cell on the nerve-fibril, or in cases where the cells have been brushed away, but leaving the Figures, which then soon become abnormally large. In the latter no cell protoplasm is present, and consequently the Figures must be produced by the fibrils.

2. Free intercellular nerve endings are produced by the intracellular fibres losing the cells with which they are connected, as in the case when the latter die or are cast off. This is evident from the fact that free intercellular endings are most abundant between the superficial cells.

3. So far as yet observed, the intracellular fibrils never end in the nuclei.

In answer to a question by Dr. Bryce, Mr. Macallum said that the nerves of the retina terminate in the rods and cones, which he illustrated by a diagram.

TWENTY-FIRST ORDINARY MEETING.

The Twenty-First Ordinary Meeting was held on 4th April, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges was read:

1. The Canadian Practitioner, Vol. X., No. 4, April, 1885.
2. Proceedings of the Academy of Natural Sciences of Philadelphia, Part III., November-December, 1884.
3. Journal of the New York Microscopical Society, Vol. I, No. 3, March, 1885.

4. Science, Vol. V., No. 112, March 27th. 1885.
5. Contributions to North American Ethnology, Vol. V., from the Bureau of Ethnology, Smithsonian Institution, Washington, D. C.
6. Curious Facts Concerning Man and Nature, Medical Series, Nos. 3 and 4. Probable Epithelioma cured by Astringent Washes. Reminiscences of Rev. Dr. Wells. Presented by Dr. Samuel W. Francis, Newport, Rhode Island.
7. The American Journal of Science, April, 1885.
8. Bulletin of the United States Geological Survey, Nos. 2, 3, 4, 5 and 6.
9. The Lineal Measures of the Semi-Civilized Nations of Mexico and Central America, by Prof. Daniel G. Brinton, Academy of Natural Sciences, Philadelphia. Presented by the author.
10. Monthly Notices of the Royal Astronomical Society, Vol. XLV., No. 4, February, 1885.
11. Abhandlungen aus dem Gebiete der Naturwissenschaften; herausgegeben vom Naturwissenschaftlichen Verein in Hamburg, VIII. Band, Hefte I., II., III.
12. Bulletin de la Société Royale de Botanique de Blgique, Tome Vingt-troisième, 1884.

Mr. James Bain, jun., read a paper on "The Present Condition of the old French Fort at Ste. Marie":

Mr. Bain briefly summarized the history of the French mission to the Hurons from 1633 until its destruction in 1649 by the Iroquois.

After describing the fort and church built by the Jesuit Fathers at their mission station of Ste. Marie on the River Wye, near the present town of Midland, he exhibited a ground plan, extracted from the Relations des Jésuites, showing the line of fortification and the moat which surrounded it.

He stated that in 1856 some of the walls were six feet high, but on visiting it in 1884 he was grieved to find that the only traces of it were to be found in a few heaps of earth and broken stone. After describing the general appearance of the surrounding country, Mr. Bain presented to the Institute a plan showing the present positions of the earth heaps and of the depressions where the moat and canal had been.

Mr. Boyle stated that the collection of antiquities on the table was intended as the beginning of a collection to be kept in the Institute, and spoke of the necessity of preserving specimens and records. Ruins should be observed, measurements taken, drawings made, &c. Farmers and others should be asked to be careful of discoveries. He himself had made a discovery of beads in a cave on the Grand River. Referring

to Mr. Bain's statement that the Jesuits had planted a hemlock as a memorial of the burial of Brébeuf, he questioned whether a hemlock will last 200 years.

The President, alluding to the statement that some of the Hurons had fled to Manitoulin from the invasion of the Iroquois, said that Manitoulin was not mentioned in the Relations, and suggested that probably Beausoleil Island was meant, where he had seen ruins, which he briefly described.

TWENTY-SECOND ORDINARY MEETING.

The Twenty-Second Ordinary Meeting was held on 11th April, 1885, Dr. G. Kennedy, 2nd Vice-President, in the Chair.

The minutes of last meeting were read and confirmed.

A communication was read from the Governor-General's Secretary, enclosing a despatch from the Earl of Derby, Secretary of State for the Colonies, expressing the high appreciation of Her Majesty's Government of the services rendered by Mr. Sandford Fleming, C.M.G., in connection with the Prime Meridian Conference at Washington.

The following list of donations and exchanges was read :

1. Bulletin of the Essex Institute, Vol. XV., Nos. 10-12, Oct., Nov., and Dec., 1883.
2. Science, Vol. V., No. 113, April 3rd, 1885.
3. Journal of the Franklin Institute, April, 1885.
4. Elephant Pipes in the Museum of the Academy of Natural Sciences, Davenport, Iowa, by Charles E. Putnam, Esq.
5. The Osteology of Amia Calva, by Dr. R. W. Shuffeldt, U. S. Army.
6. Records of the Geological Survey of India, Vol. XVIII., Part 1, 1885.
7. Bulletin de la Société d' Anthropologie de Paris, Tome Septième (III.e Série,) 4e Fascicule, Juillet à Décembre, 1884.
8. Bulletin de la Société Géologique de France, 3e Série, Tome XIII., No. 2, 1885.
9. Mémoires et Compte Rendu des Travaux de la Société des Ingéniéurs Civils, Janvier, 1885, 4e Sérié, 38e Année, 1er Cahier.
10. Boletin de la Academia Nacional de Ciencias en Córdoba (Republica Argentina) Tomo VII., Entrega 3a.

Mr. Ernest E. T. Seton read a paper entitled "Outlines of Ornithology," in which, after outlining the general anatomy of birds, he gave pretty full descriptions of a number of birds found mainly in the Canadian Northwest.

Mr. Boyle had observed the American cuckoo hovering about other birds' nests, and asked if it laid its eggs in them; referred to the fact telegraphe from Australia to the British Association in Montreal of the discovery that the ornithorhynchus lays eggs; and said that the projection on the bill of the female hornbill seemed intended to prevent her from getting out of the nest when imprisoned by the male.

Mr. McDougall had found near Winnipeg four different kinds of eggs in one nest; did not think the prairie lark so musical as the English lark; and referred to the sandhill crane as difficult to approach and swift in running, with a flavour like the wild turkey, although a different species.

In reply, Mr. Seton said there were two species of cuckoo in Canada—the black-bill and the yellow-bill—the former being regular in rearing its young like other birds, but the other very irregular; that the meadow lark has different songs in different seasons; and that the horny projection on the bill of the female hornbill is in breeding time only.

TWENTY-THIRD ORDINARY MEETING.

The Twenty-Third Ordinary Meeting was held on 18th April, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges was read:

1. Transactions, No. 1, 1879-80, of the Ottawa Field Naturalists' Club.
2. Bulletin of the Philosophical Society of Washington, Vol. 7, 1885.
3. From the New York State Library, Albany, Library Reports, 65th and 66th, 1882, 1883; Reports of the New York State Museum of Natural History, 28th, 33rd to 37th; Documents relating to the Colonial History of the State of New York, Vol. XIV.
4. The Opportunities of the Medical Profession and their Demands, by W. H. Bailey, M.D.

5. The Journal of Speculative Philosophy, Vol. XVIII., No. 3, July, 1884.
6. Science, Vol. V., No. 114, April 10th, 1885.
7. Appleton's Literary Bulletin, Vol. IV., No. 2, March to April, 1885.
8. Report of Proceedings of the Seventeenth Annual Convention of the American Railway Master Mechanics' Association in Convention at Long Branch, N. J., June 17th, 18th, 19th, 1884. Presented by J. D. Barnett, Esq.
9. A Primer of Tariff Reform, by David A. Wells, from the Committee of the Cobden Club.
10. "The British Association in Canada," by Sir J. Henry Lefroy, K.C.M.G. Presented by the author.
11. Anales del Circulo Médico Argentino, Año VIII., Febrero, 1885, Tomo VIII., Num. II.
12. Annales des Mines, Huitième Serie, 6e Livraison de 1884, Tome VI.
13. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Sitzung von December, 1884.
14. Correspondenz-Blatt der deutschen Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, XVI. Jahrgang, Nr. 3. März, 1885.

It was resolved, on motion by Prof. Pike, seconded by Mr. VanderSmissen: That Dr. Ellis, Mr. Sandford Fleming, Col. Gzowski, Mr. Alan McDougall, Mr. Kivas Tully, Mr. C. Carpmael, Prof. R. Ramsay Wright, Prof. Chapman, Prof. Galbraith, Prof. Pike, Dr. Oldright, and Dr. Bryce be requested to act as a committee to indicate to the City Council the advisability of making an immediate investigation of the currents in the lake near Toronto before taking any steps to decide the position of the trunk sewer.

The following paper on "The Ancient Egyptian Language," by the Rev. George Burnfield, of Brockville, was read by Mr. M. L. Rouse:

ANCIENT EGYPTIAN LANGUAGE.

The small country of Egypt once stood in the van of nations in many departments of arts and science. Egypt proper extends only from the Mediterranean on the north, to Assouan on the south, in lat. 24. The Lybian Desert hems it in on the west, and the Arabian Gulf and the River El Arish on the east and north-east. The area within these limits contains about 100,000 square miles.

The bulk of the arable soil is contained within the triangular shaped Delta. The apex of this triangle may be placed near Heliopolis, a line from this point to Alexandria will represent the perpen-

dicular, another extending towards Pelusium the hypotenuse, while the coast line from Alexandria to Port Said will represent the base.

South of Heliopolis Egypt's arable soil is confined to the Nile valley. Through this valley sluggishly flows the old Nile, of whose source and annual rise Herodotus tells so many marvellous stories. On each side of the river is a level strip of land, reaching back to the flanks of the mountain ranges. The part of this area contiguous to the river only is fertile, while over the remote parts the sands of the Desert maintain the mastery, and a perpetual struggle is carried on by the river on the one hand and the sand on the other.

The valley gradually contracts southward, until the arable land becomes a mere strip which the Fellahîn cultivate in the most Primitive method, and from which they derive the most scanty pittance. These green strips and the few palms, under whose shade the toiling Egyptians find shelter from the sun, are merely sufficient to relieve the monotony of barren sand and sun-bleached hills which meet the eye everywhere else. Only a little more than the tenth of the whole area of Egypt is capable of cultivation, so that only ten or eleven thousand square miles are the producing area. It is plain, therefore, the population must always be very limited.

The most reliable statement gives Egypt now a population of about five million. In a country whose soil is so fertile, and which can produce two crops of wheat a year, a much denser population can be sustained. In ancient times the agricultural appliances seem to have been of the same kind as those now used, and as the Nile is Egypt's perpetual fertilizer, the country was capable of supporting as dense a population then as now. Perhaps at no time has the population been so great as to test the producing power of the soil, for from the 12th Dynasty onwards, the period of Egypt's greatest achievements in war, in architecture and literature, the foreign wars were a steady drain on the population.

In that small country were laid the foundations of mathematics, astronomy and literature; and there, too, art achieved some of its mightiest and finest triumphs. On its soil the flag of almost every civilized nation has been unfurled, and the annals of Egypt, on Papyrus Rolls, on the walls of ancient temples and tombs, record victories over now forgotten tribes and over powerful nations. Such a people is worthy of our study, who could erect massive pyramids and temples, that line the banks of the Nile for nearly 1,000 miles,

and where are to be seen columns and capitals carved with a delicacy and fidelity to nature not excelled in the palmiest days of Grecian Art.

In the Egyptian language there is a subject of deep interest to every philologist, as well as to every investigator into the origin and development of the early races to whom we owe so much.

In order to determine the fundamental nature of the Egyptian language, it would be of immense advantage could we determine the original locus of the race prior to its immigration into the Nile valley. One theory is that the race was Hamitic, and came into the Nile valley and the Delta from Ethiopia, which probably represented modern Nubia and Abyssinia. The race, however, seems to have come westward from the Accadian Highlands and the Euphrates valley. They could reach Ethiopia by two ways, either by taking a south-westerly route until they came to the Mediterranean, and thence to the fertile plain of the Delta, or by coming south through Arabia, and then crossing the Arabian Gulf, they could have penetrated the desert, near Suakim, or any suitable landing place in that region, and thence reached any part of the interior. It is scarcely credible, however, that any branch of the primitive stock would have undertaken a march through the terrible desert of the Arabian Peninsula, and would have accomplished a much more perilous task of crossing the Arabian Gulf. A long march southward along the Persian Gulf, and then a passage over the Indian Ocean, south of the Arabian Peninsula, would have been a much more improbable enterprise. The ancient line of travel, between Egypt and the countries on the north-east of her, extended along the Mediterranean shore, through Phœnicia and Syria to Babylon and Nineveh. Moreover, it is an admitted fact that the oldest monuments are in lower or northern Egypt. The Pyramids, the monuments of Memphis, the temple of Heliopolis, and the ancient one at Denderah, are much older than those of the south. This would seem to indicate that the original Egyptians settled first in the north, and gradually moved southward as enterprise or social necessity or war forced them.

Besides it is a logical and forcible inference that there would have been Nigritic blood in the veins of the early Egyptians if they had been either the original inhabitants of Ethiopia, or had by conquest or treaty settled in pre-historic times among the original inhabitants

of that country. But the flesh colouring on the most ancient Egyptian tombs is brown with a tinge of red, and the form of the features is not Nigritic. It is not until the time of the 25th Dynasty that there is evidence of Nigritic blood in the veins of the Egyptian kings. The features of the Sphinx are not Nigritic, and the colouring, yet visible, is of a reddish hue. The lips are full, but that is the case with the Semites, whose original locus was, in my judgment, the same as the first settlers in the Delta. A side view of the Sphinx gives one the impression that the ideal of the sculptor who chiselled the features of that colossal symbol of royalty and wisdom, which has remained a silent and unchanged witness of the rise and fall of kings and of the Egyptian race, was a Caucasian face.

The original immigrants probably came in isolated tribes, and, thus spread over the Delta, would occupy and till an area of soil which would become the property of the tribe that cultivated it. An ancient historic document says that the sons of Mizraim, the people who dwelt in Upper and Lower Egypt, were the Ludim, Anamim, Pathrusim. That is, these were the tribal names of the descendants of the original Egyptians, and some of these names are verified, for they are the names of places in Egypt in historic times. Probably offshoots of those original tribes pushed westward and southward, and though retaining the language of the tribes in the Nile valley, in time they were regarded as an alien people. And we find in the period of the Thothmes and Rameses, and even earlier, that the Egyptians hated the Cushites on the south, and treated them as a foreign people, while they seem to have been able to understand the Cushites, and communicate with them without interpreters.

Whatever their original source may have been, the evidence of the earliest monuments and historical documents is that the Egyptians at that time were a mixed people.

Professor Rawlinson says (R. Vol. I. 100): "Neither the formation of their skulls, nor their physiognomy, nor their complexion, nor the quality of their hair, nor the general proportions of their frames, connect them in any way with the indigenous African races, the Berbers and the Negroes."

Dr. Birch says:* "On the earliest monuments they appear as a red or dusky race, with features neither entirely Caucasian nor Nigritic; more resembling at the earliest age the European, at the middle period of the Nigritic races, and at the most flourishing

period of their Empire, the sallow tint and refined type of the Semitic families of mankind." (Egypt from Earliest Times, page 9).

This double element visible in the race is evident in their language also. The essence of the language, its blood and marrow, is Semitic, while its form or structure is to some extent Turanian.

Bunsen says (Vol. V., Egypt's Place in History, p. 87): "The Egyptian roots find their organic development in both the Semitic and Aryan system of languages; the Egyptian grammatical forms also contain germs afterwards developed sometimes as Semitic, sometimes as Aryan forms, sometimes as both."

The Egyptian is an agglutinate, monosyllabic language, expressing the persons of the verb and the declensions of the substantives by pronominal forms and prepositions glued to the verbal root and to the substantive.

Let us take the auxiliary verb *au*, "to be," as an example of the agglutinate form of the Egyptian:

Sing.		Pl.	
aua	I am	aunu	we are
auek, aut	thou art	au-ten	you are
auf	he is	au-sen	they are
aus	she is		

The root is *au*, and the final vowel sounds and syllables are contractions of the personal pronouns appended to the root. By a comparison of this verb with the Syriac or Northern Semitic form, we can see that the fundamental root and the structural form is the same in both:

Sing.		Pl.	
Hit	I was	Haun	we were
Haut	thou wert	Hautun	ye were (masc.)
Hou	he was	Hauten	ye were (fem.)
Hout	she was	Hau	they were

The Egyptian and Syriac roots are evidently here from the same source, and if the hieroglyphic or picture form be the most ancient, the Egyptian will be nearer to that original, and while the Syriac and other Semitic forms show they are descendants from that original, yet their modifications are greater. The difference between these two forms is not greater than might be expected from different branches of the same race, isolated for centuries and living under different social and physical conditions. In Egyptian the root is *au*,

in Syriac *hau*, a difference only in the rough breathing prefixed to the latter, while the terminations in both, as far as can be traced, are probably contracted forms of the personal pronouns.

The structure of the personal pronouns in Egyptian is decidedly Semitic, and strongly supports the race unity, as well as linguistic unity, of the ancient Egyptians, the Semites of the Arabian Peninsula, Palestine and Syria, and the Semitic Assyrians and Babylonians, who occupied the Euphrates and Tigris valley.

The Egyptian personal pronouns are:

Sing.		Pl.	
Anak	I	Enen Anen	we
Entek	thou	Enteten	you
Entef, Su	he	Entesen, Sen	they
Entes	she		

The Assyrian pronouns are:

Sing.		Pl.	
Anacu	I	anakhni	we
atta	thou	attunu	you
su	he	sun	
si	she	sin	thev
		sunutu	

The Hebrew pronouns are:

Sing.		Pl.	
Anochi	I	anachnu	
attah	thou	attem	you
Hu	he	atten	
Hi	she	Hem	they, m.
		Hen	they, fem.

The Egyptian relative pronoun is Ma.
The Hebrew relative pronoun is Mah and Mi.
The Assyrian relative pronoun is Man-nu, Man, Ma-a and Mi.

On examination of the substantives there is evidence, in their root form and grammatical structure, of unity of origin in the Egyptian and Semitic languages. There are only two genders in Egyptian, masculine and feminine. This is so also in Assyrian, Hebrew, and other Semitic tongues.

The feminine termination in Egyptian is ⊂, t.
The feminine termination in Hebrew is ath.
The feminine termination in Assyrian is atu, itu, etu.

In Egyptian the plural is formed by adding *u*, or *iu* to the singular, as *Ta* the land, *Tau* the two lands. *Suten* a king, *Suteniu* kings.

The Assyrian plural forms are *anu*, *unu* and *utu*, from which the Egyptian forms may have come by modification or contraction. The final vowel, however, is the same in both languages.

The most common form of the Assyrian plural, however, is *e* or *i*, which is simply the Hebrew *im* with the final consonant omitted, and there are even examples of this plural form in Hebrew without the final *m*.

In the forms of the numerals there is an evident trace of close family relationship between the Ancient Egyptian and the Semitic languages. It is not so evident in them all, but is quite distinct in a few. And here it seems to me we might naturally expect to find greater difference of form. The Egyptians, from their mental bias, their national public works, and their social customs, continually made use of their numerals. In the measurement of land, in the computations regarding the rise and fall of the Nile, in their architecture and elementary astronomy, they would require frequently to use the numerals. Besides, on the walls of tombs and temples, scribes are seen noting down on their tablet the possessions of the Egyptian noblemen, or the spoils and prisoners of war. In such circumstances, and among such a people, we might expect a *priori* a considerable divergency between the Egyptian forms of the numerals and those of the Semitic and Aryan tongues.

The following table will show the close relationship, however, of a few of the numerals :

Egyptian.		Heb.	Sanskrit.	Assyrian.	Greek.	Lat.	Germ.
uâ	one	Echad	eka	akhadu or edu	*εἷ*	unus	ein
sen	two	Shenayim		sanie			
ses	six	Shishah	shash	sisatu	*ἕξ*	sex	sechs
sefekh	seven	Shivah	saptan	sibittu	*ἑπτά*	septem	sieben

In the Hebrew for two, the dual form is used, which if we remove, the form then will remain almost identical with the Egyptian. If we take the Hebrew form for six which is employed with feminine nouns, we have *Shesh*, which displays its intimate relationship with the Egyptian *ses*. In the above table it will be seen that the least variety exists in the case of number seven. This seems to me to be accounted for probably in this way. This was the sacred number among the Semitic and Egyptian races, and would be likely, therefore, to undergo less change than the others. The form that embodied their religious ideas would soon come to be regarded as sacred as the

ideas themselves. And in this way there would be a strong tendency to retain the form unchanged.

If we examine carefully the Egyptian and Semitic vocabularies, we shall discover a considerable Semitic element as an essential factor of the Egyptian language, not Semitic proper names or terms introduced during the time of the Thothmes and Rameses of the 18th and 19th Dynasties, or even prior. But we shall find a Semitic element in the terms used to denote the simplest objects, and to which every race must have applied names from the time when phonetic sounds were employed to denote either some quality or the essence of an object.

The following table will help to show this relationship by a few examples:

Egyptian.		Hebrew.		Assyrian.		Sanskrit.	Lat.	English.
ma	water	mayim		me				
ab	a priest	ab	a father	abu				
mut	mother	em		ummu	a father	mâtri	mater	mother
mut	to die	muth		mutu		mari	morior	murder

Egyptian.		Hebrew.		Assyrian.		Sanskrit.		Greek.	Lat.
Bet	a place	Baith	a house	Bitu	Bhû	to be		*Φύκος*	
Neb	a Lord	Nabi	a prophet	Nabu	Naripa	a prince			
Ar	to be, to do	El	a god	ilu	Isvara	a god, one who possesses			ille

Thus far, I think, I have proved the truth that the Hieroglyphic language is Semitic, to a considerable extent, both in its essence and grammatical structure, which so far gives evidence in support of the race unity between the Egyptians, the Semitics, and also the Assyrians and Babylonians. Besides, I think, we have seen here and there in the features of some of the Aryan languages sufficient resemblance to the ancient Egyptian Hieroglyphic to warrant us in the opinion that if she be not their old mother, she is, at least, a very ancient relative, whose form, to some extent, as a hereditary inheritance, they retain even to this day. Thus the ancient Egyptians were related in race and language with the warriors of the Euphrates valley, and the Semites of Syria, Palestine and Arabia, and also with the Greeks, Latins, Teutons, who, in later days, made their power in arms, in literature and art, felt among the nations that have risen since.

The Egyptians employed three distinctive species of writing, Hieroglyphic, Hieratic and Demotic. The first was used on massive

columns, and on the walls of temples and tombs. The second and third forms were used on the papyrus rolls, were merely cursive forms of the Hieroglyphic, and were employed when education became more common among the masses of the Egyptians.

Generally it may be stated the most ancient form of writing among the Egyptians was symbolic, that is, certain forms were employed to represent specific objects. At that time their language was in the same stage as that of the Aborigines of this continent, whose pictorial representations are yet visible in parts of Canada, or of the Aborigines of Mexico, who, to some extent, employed the same method, and who probably would have reached in time a phonetic stage in their language, when the same or other forms would have conveyed their ideas and the names and qualities of objects.

This stage of human language is a primitive one, and dates back to the time of the Assyrian and Babylonian Empires, whose annals are recorded in the cuneiform on the clay bricks and stone cylinders found in the libraries and ruins of Nineveh and Babylon. Its progenitor, the Accadian, seems to have been a hieroglyphic language in which specific forms represented an idea or an object. The Assyrians, the successors of the Accadians, attached phonetic values to the forms, and perhaps modified them into the cuneiform as now found on the monuments in the British and other museums. As an example of this change let us take the word for sun. Its primitive Accadian form was as nearly circular as straight strokes would admit. The Assyrians changed the form into a perpendicular line, preceded by two lines at an angle, attached a phonetic value and pronounced it *samse*. In Egyptian the form to denote the sun was a circle with a dot in the centre. Afterwards, when the phonetic stage was reached, the phonetic value of *ra* was given to it, and the original form was placed as a determinative after the phonetic signs employed to express the syllable ra.

The Egyptian Hieroglyphic forms were occasionally used figuratively. In some instances we can easily trace the figurative meaning of any particular form from the literal; in others this is impossible, the figurative meaning having been imposed arbitrarily, or at least the connection between them is not now perceptible. The circle which denotes "sun" signifies also "day" in many of the texts, though not the usual word. The connection here is quite obvious. The sun-god was supposed to sail across the sky in his boat, and then

to sink into Amenti or the Western Hades, whence he rose every morning from the Eastern horizon. One journey of the sun-god being a day, the same word Ra denoted both the sun and also a day. The serpent was the symbol for asp, and also denoted a "god," and is found on the crown of some of the old Egyptian rulers, signifying the power and wisdom of the king. It is quite easy to perceive the figurative use of the serpent form. The sting of the Cobra was incurable by any known Egyptian remedy. Probably, therefore, to propitiate it, and also as a tacit acknowledgment of its deadly power, they gave it a place in their Pantheon.

The segment of a circle signified both the moon and a month, for the Egyptian month seems to have been determined by the lunar revolutions, and the year to have consisted of so many of them, with intercalated days at the end of the year.

In the old Assyrian the same method was adopted with a slight variation. The wedges placed as nearly as possible in the form of a circle denoted the sun. Three angular figures denote 30. These figures placed within the circle denoted the month, consisting of 30 days. The modern Assyrian form was modified into – ‾ ‾ ¦, with the phonetic value of *Arkhu*.

From the earliest historic time the Egyptian hieroglyphs were phonetic. They represented either a letter or a syllable, which was resolvable into its separate letters. The following method was adopted in employing a sign to convey a particular sound. They employed an object, which was denoted by a word, whose first letter was identical in sound with that which they wished to express. Hence the Eagle was the sign of the A sound, because the name of the Eagle in Egyptian *Akhôm* contained in its first letter the sound required. A reptile became the sign of the letter T for the same reason, for the first letter of *Tetef*, the Egyptian for reptile, begins with the sound required.

The Egyptians increased the difficulties of their language by arbitrarily employing a number of signs to convey the same sound. To denote the sound of A they used a palm branch, the figure of an Eagle, and a hand with the arm outstretched to the elbow.

To express the sound of the letter T they used the palm of the hand; two parallel lines, united at one end by a curved line and terminating at the other in small circles; and the segment of a circle. Their numerous syllabic signs, and the use of various signs to express

the same sound, must have made the study of this interesting language a laborious business to the common people. And in this fact, among others, we can see how very naturally the Egyptian scholars were the Egyptian priestly class, and the men of leisure.

The Ethiopians were known to the Hebrews as Cushites, the same name by which the Egyptians designated them on the monuments. But the most ancient historic document we have classifies the Cushites, Canaanites and Egyptians as originally tribes from the same Hamitic stock. This fact is supported by independent and valid evidence. From the earliest historic times a most intimate connection existed between Egypt and Ethiopia on the south. The Ethiopian armies served with the native Egyptian, and the Egyptian kings found an asylum and support there when their own land was invaded and subdued by foreign enemies. The kings of Egypt even married Ethiopian princesses, when no state reasons required them to form such a bond of union with their southern neighbours. In all this varied intercourse no interpreters were employed. No record, at least, is given of such a fact, and we may reasonably infer, therefore, that the Egyptians understood the language of the Cushites, and therefore that the Egyptian and Cushite language were similar, if not identical. From these facts it might be inferred a *priori* that there would be an essential resemblance between the Egyptian Hieroglyphic and Ethiopic, and this is true as a matter of fact, From this brief survey of the ancient Egyptian Hieroglyphic, I think we may deduce the following conclusions:

1. That it is closely allied with the Accadian and the modern Assyrian, as found on the tablets and monuments discovered in the ruins in Mesopotamia.

2. That the Egyptian Hieroglyphic is in some of its fundamental parts Semitic, and points to a common origin with Hebrew, Syriac and Arabic.

3. That it was the same in its origin and essence as the language of the Cushites on the south, which is substantiated by the fact that there is a somewhat close affinity between the Egyptian Hieroglyphic, or its descendant the Coptic, and the Ethiopic.

4. That an affinity exists between the Egyptian and some of the Aryan languages, as Sanskrit, Greek, Latin and German.

5. And as a final conclusion of the survey of this archaic language once spoken by the race that has left behind it the most lasting

colossal and ingenious works of their skill and industry on earth, we can see that comparative philology helps its sister science Ethnology, and tends to lessen the area on which rose the primeval language, and strengthens the probability of the origin of the race and of language from one original centre.

TWENTY-FOURTH ORDINARY MEETING.

The Twenty-Fourth Ordinary Meeting was held on 25th April, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges was read :

1. Monthly Weather Review, Dominion of Canada, March, 1885.
2. First Supplementary Catalogue, Central Circulating Library, Toronto.
3. Bulletin of the Natural History Society of New Brunswick, No. IV.
4. Transactions of the American Society of Civil Engineers, January, 1885.
5. Transactions of the Buffalo Historical Society, Part III. Obsequies of Red Jacket at Buffalo, October 9th, 1884.
6. Science, Vol. V., No. 115, April 17th, 1885.
7. Bulletins of the Illinois State Laboratory of Natural History, Nos. 1, 2, 5, 6, and Vol. II.

   Twelfth and Thirteenth Reports of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois.
8. Monographs of the United States Geological Survey, Vol. IV.
   " Comstock Mining and Miners," by Eliot Lord.
9. Proceedings of the London Mathematical Society, Nos. 235–236.
10. Proceedings of the Royal Geographical Society, N.S., Vol. VII., No. 4, April, 1885.
11. Trübner's American, European, and Oriental Literary Record, Nos. 207–208, N. S., Vol. VI., Nos. 1–2.
12. Transactions of the Manchester Geological Society, Parts IV., V., VI., VII., Vol. XVIII., Session 1884-'85.
13. Archivio per l'Antropologia e la Etnologia, Quattordicesino Volume, Fascicolo Terzo.
14. Atti della Società Toscana di Scienze Naturali, residente in Pisa, Memorie, Vol. IV., Fasc. 3o.
15. Bulletin de la Société d' Anthropologie de Paris, Tome Septième, (IIIe Série,) 5e Fascicule, Décembre, 1884.
16. Mitheilungen der Anthropologischen Gesellschaft in Wien, XIV. Band, IV. Heft.

Messrs. C. G. Richardson and W. T. Tassie were elected members.

Nominations for Officers for the ensuing year were then made.

Mr. Frank T. Shutt, B.A., read a Paper on "The Anatomy of the Wood-Louse," illustrated by diagrams and specimens. The following is an abstract:

NOTES ON THE ANATOMY OF THE WOOD-LOUSE.*

This paper opened by discussing the various classifications of the Crustacea by Huxley and others, and concluded its remarks upon this subject by adhering to the classification which places the Oniscidae as a family of the Isopoda, the latter being ranked as an Order of the Edriophthalmia.

A general description of the anatomy of the Isopoda followed, which points out the most characteristic features that serve to distinguish the forms of this order from those of related orders, *e.g.*, respiratory function of lamellate abdominal feet; absence of Cephalothorax, etc.

The life-history of the members of this Order was then briefly outlined, and it was shown that although the vast majority of them were marine, many were fresh water types, and others, as the Oniscidae (to which the Wood-Louse belongs) were terrestrial. The fact was also noted that such terrestrial forms were always found in damp places, and therefore that moisture was necessary for the act of respiration. The family of the Oniscidae, while somewhat isolated, is yet a widely spread group, being found in both Hemispheres, and as far north as Greenland.

The anatomy of the parts and appendages was then fully described, the descriptions being accompanied by drawings made by the Author.

The segments of the head, thorax and abdomen, as to their shape, colour, etc., first received treatment, and then a more minute account of the attachments followed.

With regard to the appendages of the Head, the most important features to be noticed are—the possession of a single pair of Antennæ. These are the Antennæ proper. This seems to point to a high degree of development in the Oniscidæ, and in conjunction with the fact that the mandibles possess no palps causes them to resemble some of the Myriapoda. The eyes are sessile, black, slightly convex, and are

* This paper was awarded the McMurrich Medal, Univ. Coll., Toronto, 1885.

oval in outline; they consist of an aggregation of ocelli. The Maxillipedes are broad, lamellate structures, and of comparatively large size. Their inner margins meet in the median line, and are nearly straight. A short, thick palpus, of three joints, is borne by each Maxillipede on its upper and outer margin, in front of which it projects. The under-lip is attached to the Maxillipede, and is produced externally to it. The second pair of Maxillæ is flat, foliaceous, and of the same breadth throughout. It bears a cap of chitine on its upper and inner angle. The inner or first pair of Maxillæ possesses both endopodite and exopodite; the latter is considerably the longer and stouter, and bears five inwardly-curved chitinous denticulations, and its outer border is beset with fine setæ. The endopodite is composed of two joints, both slender, the upper one tipped with two feather-like setæ. The Mandibles are strong and of considerable thickness, being circumscribed by a horny skeleton- and bearing three bluntly pointed teeth at their apex, and patches of fine setæ on their inner and outer edges. The Labrum, above the Mandible, is apparently a paired structure. It protects the oral aperture. In structure it is foliaceous, and may be regarded as a median growth of the sternum of this region.

The Thoracic Appendages, seven in number, bear a strong simi, larity one to another. They are composed of seven joints, and none are chelate. A more exact description of them then followed.

Of the six abdominal appendages five are concealed under the abdomen—the uropods (appendages of the sixth somite) projecting behind. The various modifications of these abdominal appendages in the sexes then is dwelt upon at some length.

The uropods are alike in both sexes, and consist of a basal segment bearing two rami.

The President, for Dr. Robert Bell, of Ottawa, read the following paper on "The Mode of Occurrence of Apatite in Canada," by Robert Bell, B.A.Sc., M.D., LL.D., Assistant Director of the Geological Survey of Canada:

The mode of occurrence of apatite in the crystalline rocks of Ontario and Quebec, has been a puzzling question to geologists ever since the mineral has been known to exist among them in quantities of economic value. A number of contributions to a knowledge of

the subject have been made, principally by Sir W. E. Logan, Drs. Hunt, Dawson, and Harrington, Professor Dawkins, and Messrs. Vennor, Broome, Willimott, Kinahan and Torrance.

The scientific aspects of the subject are discussed more particularly by Dr. Harrington in the Geological Survey Report for 1877–'78, and by Dr. Hunt in several of the Survey Reports, and also in an excellent paper in the Proceedings of the American Institute of Mining Engineers, in which he gives valuable statistics of the production of Apatite in the Dominion. The rapid progress which has been made in mining the Apatite during the last two or three years, has enabled us to obtain some additional light on this question.

With the exception of one locality at Lake Clear, in the County of Renfrew, the workable deposits as yet known are confined to two areas having similar geological characters and relations, the one running north, in the County of Ottawa, and the other south-west, through parts of Lanark, Leeds, and Frontenac. Apatite has been found in other regions in Canada, but for the present I shall confine my remarks to the two areas I have mentioned, and moreparticularly, to the one in the County of Ottawa, which latter I have had more opportunities of examining than the other.

The Apatite-bearing rocks belong, as is well known, to the Laurentian system, and they appear to constitute one of the higher members of the series. Although the Laurentian system extends over such vast tracts of country in the northern regions of the Dominion, rocks like those among which the Apatite occurs appear to occupy but a small proportion of the whole area. In the great regions referred to, scarcely anything is to be found but wearisome repetitions of the commonest varieties of greyish and reddish felspathic and quartzose gneisses—massive, highly crystalline, hard, granitoid, or not much more cleavable in the direction of the lamination than across it, greatly contorted on the small scale, and so much disturbed on the large scale that it would be almost impossible to map out all the windings and foldings in any given given area.

In the Apatite-bearing regions on the other hand, the rocks on the large scale, or geographically speaking, are arranged in great belts, differing more or less from one another, and individually traceable for long distances, in which they maintain their distinctive characters. The limestone bands which they contain constitute the great distinguishing feature in which these strata differ from the bulk of the

Laurentian rocks. In the immense northern Laurentian country to which I have referred, and which occupies many hundreds of thousands of square miles, no limestone bands have yet been detected, although it is probable that other areas of the higher portions of the series containing such bands may yet be found. The Laurentian areas at present known to hold these limestones lie along the southern parts of the Dominion between the French and the Saguenay Rivers. Limestones are also found in rocks classified as Laurentian in Cape Breton and Newfoundland. In the apatite regions the gneisses of some of the bands are less crystalline than the primitive varieties above described, and they are recognizable throughout by certain peculiarities of color, composition, &c. They are seldom so much disturbed as to prevent them from being traced out upon the ground. While the common Laurentian gneiss holds but a small variety of minerals, the rocks of the apatite regions have already yielded upwards of sixty species. Both in the county of Ottawa and in the Perth and Kingston regions there are several wide bands of crystalline limestone rudely parallel to one another and separated by great thicknesses of gneissic strata. These are similar to the thick bands of limestone in the gneisses of the county of Argenteuil, which were so carefully traced out in all their windings by the late Sir W. E. Logan between the years 1854 and 1862. Apatite has been found in various places in this region, but apparently not in paying quantities so far as is yet known.

Besides the limestones, the Laurentian rocks of the apatite regions have associated with them bands of schists, slates, pyroxenite, quartzite, jasper, etc., and they also contain serpentine, graphite, pyrite, pyrrholite and ores of iron, copper, lead and other metals.

Coming now to the closer associations of the apatite itself, we find that it is almost invariably accompanied by pyroxenite, which may be either coarsely or finely crystalline and of any shade of green, greyish-green, and grey. A somewhat coarsely crystalline orthoclase rock, generally very light grey in color and spotted and mottled with pink, lilac and neutral grey is generally found with the apatite, especially in the valley of the Rivière du Lièvre. The other minerals most commonly associated with it are dark mica, which in most cases is biotite, but may occasionally be phlogopite, pyrite, white, red, pink, flesh and salmon colored calcite.

In some localities, as in the township of Wakefield, the apatite is

accompanied by a very crystalline and distinctly spotted or mottled diorite in which the hornblende is dark green or black, and the felspar white, grey or reddish. A dull red, rather fine-grained gneiss, streaked and spotted with dark grey or black, is found in proximity to the apatite deposits in some parts of Ottawa county. Interstratifying the gneiss near a number of the apatite deposits in the valley of the Lièvre, I have noticed thin seams and also beds, up to several feet in thickness, of a quartz-rock which is white or light bluish in color, semi-translucent, non-crystalline or compact, pitted or honeycombed on weathered surfaces, the cavities being apparently due to the dissolving away of felspar.

It is well known that some of the metals exhibit a preference, locally at all events, for certain rocks which, as the miners say, are "kindly" to them; as for example (among the old crystalline rocks), oxides of iron with hornblende schists, galena with limestone, sulphides of copper with greenstone and talcoid schists, gold with quartz, tin with granite, etc. There is thus nothing extraordinary in the association of the apatite of the Laurentian system with pyroxenite.

We have seen that, in regard to the apatite of Ottawa county at any rate, there are certain pretty well ascertained geological and mineralogical associations, so that should we find these conditions repeated in another region, among the widely-spread Laurentian rocks of Canada, we may look with some confidence for apatite. These conditions may be briefly recapitulated as follows: a somewhat regular large-scale structural arrangement of the gneiss in bands, having distinctive characters and accompanied by limestones, a considerable number of "the Laurentian minerals," and the presence of pyroxenite or of mottled diorite. For these reasons I have ventured to predict the probable discovery of apatite in the Parry Sound district ever since 1876, when I made a geological reconnoisance of the district and found five distinct limestone bands, of which the general positions and courses were indicated, and to which I gave separate names – (See Geol. Survey, Report of Progress, 1876-77, pages 202-208). The general structure and character of the Laurentian rocks to the north-eastward of the Georgian Bay would place them among the higher divisions of the system. In this region I also found the mottled diorites and the pyroxenites which, in the county of Ottawa, indicate the proximity of apatite. A considerable

number of the mineral species which usually accompany the Laurentian limestones was also found.

In the county of Ottawa the most productive "phosphate belt" as yet known runs northerly and follows the general course of the Rivière du Lièvre. It has been traced through the townships of Templeton and Buckingham, Portland, Bowman, Bigelow and Wells, and I have been credibly informed that the mineral has been found in places in this direction to a distance of 100 miles from the Ottawa. In the Perth and Kingston region, the phosphate belt runs from the township of North Elmsley south-westward through North Burgess, North Crosby, Bedford, Storrington and into Loughborough.

There is little doubt that the apatite has been derived principally from the pyroxene rocks. Phosphate of lime in small quantities is a common constituent of igneous rocks. Dr. Harrington has shown that the trappean rocks of the isolated mountains in the Province of Quebec contain it in very appreciable quantities, and it has been met with in the amygdaloids of the Bay of Chaleur. I have found bunches and crystals of apatite associated with amygdaloid and syenitic granite at Trout Lake at the source of one of the branches of the Moose River. There is no evidence whatever that the Laurentian apatite has had the remotest connection with organic life, although it is a rather curious circumstance that the average proportion of fluorine in this anciently formed mineral should approximate that contained in the bones of mammals.

The pyroxenite appears to take the form of irregular beds and almost isolated masses running with the stratification, but these have been altered in shape and partially dispersed during the metamorphism of the whole mass containing them. They have probably been originally derived from igneous sources and have perhaps formed parts of submarine ejections while these ancient rocks were in the course of deposition; or they may have been intruded subsequently. They have since all undergone great alteration and disturbance, in the course of which they have been in a heated and somewhat plastic state and have become more or less mingled with one another. It was at this remote period that the irregular and somewhat ill-defined veins of the second and third class described by Dr. Hunt as belonging to such rocks were formed—(Geol. Survey, Report of Progress, 1863-66, p. 187). These veins are very numerous among all the Laurentian rocks. They are filled with the prevailing consti-

tuents of the country rock which they may happen to traverse, such as felspar, quartz, calcite, pyroxene, apatite, mica, etc., or with some of these minerals mingled together. The gangue adheres strongly to the wall-rock which to a certain distance in is often penetrated by a greater or less proportion of the veinstone.

All writers on this subject have dwelt on the great irregularity and the puzzling character of the apatite deposits. At first the deposits were supposed to be beds, but they are now pretty commonly regarded as being rather of the nature of veins of an irregular and unusual nature. Regular veins, generally of small size, filled with apatite or having this mineral as one of the veinstones have also been described by writers on this subject. On the 2nd lot of the third range of the township of Bowman in Ottawa county, I have seen a well defined small isolated vein of pyroxene, cutting gneiss and holding masses of apatite along its centre. The mine at Little Rapids on the Lièvre appears to be in a large vein. These are probably instances of regular veins of very ancient date. But in the great majority of cases the deposits, whether of the pure phosphate or of a mixture of this with other minerals, appear to differ from true fissure veins and to be extremely uncertain and capricious in their forms.

The mineral is often much mingled with the pyroxenite, but it always has a tendency to form itself into floors and branching veins, having two principal local courses. From an attentive study of these in several of the mines which have been opened in the Lièvre valley, I have come to the conclusion that these lines of deposit mark approximately the original jointing of the rock. These ancient joints belonged to three sets, two nearly vertical intersecting each other, and one nearly horizontal, analogous to the three sets of dry joints of more recent date, which we usually see in massive rocks at the present day. In the course of the disturbances to which these phosphate-bearing pyroxenites and gneisses were subjected, the angular masses into which they had been divided by these joints became in places separated and displaced, leaving the spaces which are now filled with the apatite. The process—one of segregation—was similar to that by which the irregular veins in other varieties of the Laurentian rocks have been filled with quartz and orthoclase or calcite and its associated minerals. Indeed it has been pointed out that the tribasic phosphate of lime shows an unusually strong ten-

dency to segregate or separate itself from mixtures containing it. Hence we should expect to find that even when it formed only a small proportion of the constituents of the rock in which a cavity occurred, it would fill it up to the complete or partial exclusion of the more abundant minerals. We do not know the precise nature of the conditions which have caused the elimination of individual minerals from the country rocks, and their deposition in the veins which traverse them, but from the above considerations it is easy to conceive that the phosphates might be separated out into cavities from the enclosing rocks, in which the mineral is now but sparingly diffused, especially when we consider that apatite is soluble in heated waters holding alkaline silicates, whereas the felspars and pyroxene are not thus soluble.

In the formation of the apatite masses, or of any other vein-like deposits, it is not necessary to suppose that the whole space which they now occupy was open at once like an empty cavity, or indeed that it was ever open at all to any appreciable extent, but only that where the slightest vacancy occurred from movement in the wall-rock, it was immediately filled by particles of one or more of the minerals of the parent rock, for the transference of which the conditions were for the time favorable.

The general form of the apatite deposits as seen in a section across any of the courses of the primeval jointing approximates what we should expect to find if the above hypothesis be correct. A vein in descending, after following an ancient vertical joint past several nearly horizontal branches, may suddenly jog off to another parallel joint to which the original opening had been transferred by a lateral movement on the plane of one of the horizontal joints. The horizontal branches which are sometimes as large as the veins themselves, when exposed in place, constitute the "floors" or "beds," and they are as likely to be cut off by throws along the planes of the vertical joints as are the veins by throws along the horizontal joints. In this way either vertical or horizontal masses of apatite may be cut off suddenly all round or they may pinch out gradually or irregularly. The latter would result from the disturbance of the blocks of the country rock all separated from each other by the three sets of joints during the movemements which took place while the strata were in a plastic condition. Both the veins and "floors" of apatite are sometimes observed to curve or gradually change their dip. This

form may have been imparted to them, either during or subsequent to their formation.

The structure I have attempted to describe is best seen where the phosphate-producing rock is least disturbed and where the joint-fissures are moderately small and close together, but the same arrangement obtains among the larger deposits. The principal mass in a working sometimes passes from a vertical joint to one in another set, or from one of the latter to a horizontal joint, thus giving the mass the form of the letter L as seen in plan in the first instance or in vertical section in the second. An example of the first of these forms on a large scale is described by Mr. Torrance as occurring at Major Chapleau's Mine on lot 17, range VI, of Portland, East—(Geol. Survey Report of Progress, 1882-84, page 16 J.)

Along the intersections of any two of the planes of the joints, and more especially at the points where all three intersect one another, the apatite is accumulated in the largest quantity. The angles of adjacent blocks are frequently rounded off and thus larger spaces are found for the deposition of the mineral. Sometimes the apatite follows only one set of vertical joints, when it appears as parallel veins; at others it is nearly confined to the horizontal ones, when it forms a succession of "floors," and again it may follow both of the vertical sets or even all three, in which cases it appears in a reticulating form, which is of very common occurrence.

If the above view of the nature of the majority of our phosphate deposits in the pyroxenite be correct, we should naturally expect to find the mineral most freely exposed where upward movements of the apatite-bearing rocks had occurred, and that the deposits of the mineral between the blocks of the country-rock would be widest above, and further, that in going downward they would become pinched towards the next leading horizontal joint below, where they would open out again; also that the successive bunches of the mineral would become smaller and smaller in descending. These conditions appear to correspond with the experience of mining so far.

The great numbers of small "shows" which are found on the surface among the apatite-bearing rocks appear to afford additional proof of the correctness of the view I have put forth. Many of these have been worked to a small extent on the surface by farmers and others, but the great majority of them show a tendency to pinch out at a limited depth, when they are usually abandoned. As many as 300

of these "shows" have been opened on a single lot. Dr. Hunt and Mr. Gordon Broome have both described a group of about twenty nearly parallel veins of apatite on lot 4, range V, of North Burgess. (Geol. Survey Reports, 1863-66, pages 226-27, and 1870-71, page 317). They all diminish rapidly north-westward in receding from the shore of Rideau Lake and may belong to the class of parallel joint-deposits I have described. In this township, and those adjacent to it, the apatite is often found in isolated crystals and masses in calcite or coarsely crystalline limestone, which is generally of some reddish shade and is mostly associated with or near to the pyroxene rock. These deposits Dr. Hunt regards as veins also.

Apatite has been detected in a very large number of places in the two principal regions above referred to and in a good many localities in Renfrew county. In addition to these, it has been found in Canada in crystalline limestone in the Augmentation of Grenville and at the Calumet Falls in the latter township, at St. Roch in the parish and county of Assumption, in an intrusive mass of fine grained grey dolerite, in the township of Barford (Eastern Townships), in a vein of quartz with copper pyrites, native copper and mica. I have also found it in crystals with mica in a compact grey dolomite in the township of March, county of Carleton. It is mentioned among the minerals brought home in 1878 by Mr. Ludwig Kumlien from Cumberland Inlet, where the rocks are believed to be Laurentian. I may mention, in this connection, that near North Bluff in Hudson's Strait I have picked up a piece of crystalline limestone quite like one of the common Laurentian varieties. Sir John Richardson found apatite in the neighborhood of the Coppermine River.

I have already noticed its occurrence in igneous rocks at Trout Lake, north of Lake Huron, in the isolated mountains of the Province of Quebec, and on the Bay of Chaleur.

If the view I have taken of the mode of occurrence of our principal apatite deposits be not sufficiently elaborated or satisfactory, it may at all events point the way to further investigations in this direction.

Mr. Notman mentioned the view that phosphates being fertilizers, must be of animal origin.

Mr. Shutt, referring to a recent paper by Dr. G. Dawson maintaining that view, argued against it by showing that the

Norwegian phosphates have no fluorine but chlorides instead, and therefore must have had their origin before animal life.

Mr. Levey thought phosphorus in the rocks a primary element; in bones, only a secondary.

Mr. Livingston remarked that other stones besides phosphates were fertilizers.

The President said that the analysis of the phosphates was similar to that of bones, but that was no evidence that vegetable preceded animal life; that iron and carbon occur in connection with organic remains; without carbon there is no life; phosphates occur in the same rocks with graphite, eozoon Canadense and crystalline limestone; and even accepting the view stated, the difficulty is only carried a step back.

ANNUAL MEETING.

The Thirty-Sixth Annual Meeting was held on 2nd May, 1885, the President in the Chair.

The minutes of the last annual meeting were read and confirmed.

The following list of donations and exchanges was read:

1. The Canadian Entomologist, Vol. XVII., No. 3, March, 1885.
2. Report of the Minister of Education (Ontario), for 1884, with the Statistics of 1883.
3. The Canadian Practitioner, May 1885.
4. Monthly Health Bulletin of Ontario for December, 1884, and January and February, 1885.
5. Science, Vol. 5, No. 116, April 24th, 1885.
6. Journal of the Franklin Institute, May, 1885.
7. Annual Reports of the Trustees of the Peabody Academy of Science, Salem, Mass., 1874 to 1884.
8. Monthly Notices of the Royal Astronomical Society, Vol. XLV., No. 5, March, 1885.
9. Journal of the Royal Microscopical Society, Series II., Vol. V., Part 2, April, 1885.
10. Memoirs of the Geological Survey of India, Vol. XXI., Parts 1 and 2. Do. Palæontologia Indica, Series XIII., Vol. I., Part 4. Fasciculi 3 and 4.

11. Boletin de la Academia Nacional de Ciencias en Córdoba (Republica Argentina), Tomo VIII., Entrega 1a.
12. Anales del Circulo Médico Argentino, Año VIII., Marzo, 1885, Tomo VIII., Num. 3.
13. Ymer Tidskrift utgifven af Svenska Sällskapet für Antropologie och Geografi, Häft 1884 (Fjere argangen), 5e, 6e, 7e, och 8e, 1885 (Femte ärgoangen), 1c, Häftet.
14. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, Janvier, 1883 ; Juin et Juillet, 1884 ; Annuaire de 1885.
15. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XII., Nos. 1, 2, 3.

Mr. Joseph J. Woodhouse was elected a member. The Secretary read the Annual Report, as follows :

ANNUAL REPORT OF THE CANADIAN INSTITUTE.

SESSION 1884-85.

The Council of the Canadian Institute have the honour to lay before the members their Thirty-Sixth Annual Report.

During the past session twenty-four meetings have been held, at which thirty papers have been read. The character of the papers and the degree of interest shown in the meetings have been highly satisfactory.

It is gratifying to observe that the membership continues to increase, forty new members having been added to the roll during the past session.

The interest taken by members in the Library and Reading Room also continues to grow, as shown by the fact that while last year 860 books and periodicals were issued to members, the number this year was 1,533.

Last year an effort was made to bind the transactions and periodicals, which have for some years been allowed to accumulate. The effort has been continued this year, during which 161 volumes have been bound and placed on the shelves.

The number of transactions of learned societies received in exchange for our Proceedings continues to increase, one hundred and sixty societies having this year sent copies of their publications.

It is highly gratifying to the Council to call attention to the fact that at the International Conference held at Washington in October, 1884, for the purpose of establishing a prime meridian, the proposals first made at a meeting of the Canadian Institute by Mr. Sandford

Fleming were largely adopted. All the papers on this subject have been placed in the printer's hands, and the Council hope shortly to lay them before the Institute.

We append statements showing: 1st, the membership; 2nd, the financial condition; 3rd, the number and sources of donations and exchanges; 4th, the number of books and periodicals issued to members; 5th, the list of periodicals subscribed for; 6th, the list of periodicals presented to the Institute, with the names of the donors.

All of which is respectfully submitted.

W. H. ELLIS, *President.*

TORONTO, May, 1885.

APPENDIX I.

MEMBERSHIP.

Number of Members, April 1st, 1884	236
Withdrawals and Deaths during the past year	32
	204
Elected during the Session, 1884-85	40
Total number of Members, April 1st, '85	244
Comprised of:	
Honorary Members	6
Life Members	16
Ordinary Members	222
Total	244

APPENDIX II.

TREASURER IN ACCOUNT WITH THE CANADIAN INSTITUTE—SESSION OF 1884-85.

To Summary:		
" Balance on hand	$ 71	50
" Annual Subscriptions	570	25
" Rents	143	50
" Journals sold	101	89
" Books and Periodicals sold	79	23
" Interest on Deposits	8	14
" Donation	50	00
" Government Grant	750	00
	$1,774	51

By Summary :

" Salaries	$342 75
" Periodicals	104 56
" Interest on Mortgage	238 78
" Printing	349 14
" Fuel	99 50
" Gas	44 80
" Water	21 00
" Postage and delivering Journals	24 50
" Express	16 04
" Stationery	2 45
" Furniture	101 80
" Fencing	68 50
" Binding	183 70
" Caretaker for Sundries	10 00
" Stuffing and Preparing Specimens	32 40
" Repairs	40 20
" Insurance	52 00
" Taxes	9 49
" Contingencies	9 27
" Cash on hand	23 63
	$1,774 51

Examined and found correct.

CHARLES CARPMAEL,
J. A. LIVINGSTON, } *Auditors.*

ASSETS.

Building	$11,000 00
Warehouse	720 00
Ground	2,500 00
Library	6,000 00
Specimens	1,200 00
Personal Property	450 00
	$21,870 00

LIABILITIES.

Mortgage	$ 3,411 00
Balance in favor of Institute	18,459 00
	$21,870 00

APPENDIX III.

DONATIONS AND EXCHANGES—BOOKS AND PAMPHLETS RECEIVED FROM APRIL 1ST, 1884, TO APRIL 1ST, 1885.

Canadian	110
United States	200
Great Britain and Ireland	160
India and other British Colonies, exclusive of Canada,	80
Foreign	180
Total	730

The number of Societies with which the Institute exchanges 160

APPENDIX IV.

THE NUMBER OF BOOKS AND PERIODICALS ISSUED TO MEMBERS.

From April 1st, 1884, to April 1st, 1885. 1,533

APPENDIX V.

List of Periodicals Subscribed for is the same as last year.

APPENDIX VI.

PERIODICALS PRESENTED TO THE INSTITUTE AND THE NAMES OF THE DONORS.

Das Echo	W. H. VanderSmissen, Esq., M.A.
Spectator	Prof. Hutton
Le Courrier de l'Europe	George E. Shaw, Esq., B.A.

On motion by Mr. Alan MacDougall, seconded by Mr. VanderSmissen, the Report was adopted.

The Report of the Committee appointed to confer with a Committee of the Natural History Society was read, and on motion by Dr. Kennedy, seconded by Mr. MacDougall, was adopted.

On motion by Mr. Shaw, seconded by Mr. VanderSmissen, the Committee were instructed to carry out the details required by the Report.

The following were elected officers and members of Council for the ensuing year :

President—W. H. Ellis, M.A., M.B.

First Vice-President—George Murray, Esq.

Second Vice-President—George Kennedy, M.A., LL.D.

Third Vice-President—E. A. Meredith, LL.D.

Treasurer—John Notman, Esq.

Recording Secretary—James Bain, Jr., Esq.

Corresponding Secretary—W. H. VanderSmissen, M.A.

Librarian—George E. Shaw, B.A.

Editor—Rev. Henry Scadding, D.D.

Curator—David Boyle, Esq.

Members of Council—Daniel Wilson, LL.D., Jas. Loudon, M.A., F.R.S.C., R. Ramsay Wright, M.A., B.Sc., Alan MacDougall, C.E., F.R.S.E., Alex. Marling, LL.B., P. H. Bryce, M.A., M.D.

On motion by Mr. J. A. Livingston, seconded by Mr. McCharles, the thanks of the Institute were tendered to the President, Office-bearers, and Council in recognition of their valuable services during the past year.

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LIST OF MEMBERS

OF

THE CANADIAN INSTITUTE,

OCTOBER, 1886.

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Sykes, Sydney B..... "

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Tassie, W. T..... Toronto.
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